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LATERAL CURVATURE OF THE SPINE.

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OBSERVATIONS

ON THE

TREATMENT OF LATERAL CURVATURE

OF

THE SPINE.

POINTING OUT THE ADVANTAGES TO BE GAINED BY PLACING THE BODY IN A POSITION
TO PRODUCE LATERAL FLEXION OF THE VERTEBRAL COLUMN, COMBINED WITH
THE AFTER APPLICATION OF FIRM MECHANICAL SUPPORT.

WITH WOOD-CUTS.

BY

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HOSPITAL (FOR THE CURE OF CLUB-FOOT, LATERAL CURVATURE OF THE SPINE, AND ALL OTHER
DEFORMITIES), LECTURER ON THE APPLICATION OF BANDAGES AND SURGICAL APPARATUS
AT THE MIDDLESEX HOSPITAL SCHOOL, AND FORMERLY DEMONSTRATOR
OF ANATOMY.



LONDON:

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PREFACE.

IN the present short work, my object is to recommend a method of treatment for the cure of Lateral Curvature of the Spine, that I believe will be found to be more simple, and to be more effectual, than any hitherto adopted. It appears to me that the principle of extension is not the best to act upon, to bring the spine from the curved into the straight position; nor do I think it the most scientific, for the force tells mechanically with the least advantage, and requires that most powerful means be exerted to produce the desired effect. All curves, no matter of what nature the body, in which they exist, are more easily rectified by applying the force in an opposite direction, by *unbending* them rather than by pulling upon them at their two extremities; in the former, the advantage of a lever power is gained; in the latter, an extending force only can be employed, at the same time that it tells in the least favourable direction. This principle is

equally applicable to curvature of the spine, where the vertebral column has been *bent*, or thrown out of its natural erect line, by mechanical causes only. The spine, though composed of many small bones, is similarly circumstanced to a single long bone, that may yield or become curved, from its structure being too weak to resist any mechanical weight it may have to support, or that may be made to tell against it. The effect produced is the same in both cases, though the causes are not precisely similar. Taking this view of the subject it appears to me, that the treatment of a curvature of the spine, depending on simple weakness unaccompanied with disease of the bones or ligaments, should be conducted on the same principles as when the curvature exists in a single bone only. Bearing this principle in mind, I considered that the position by which lateral flexion of the whole vertebral column could be produced, by *bending* the spine in the opposite direction to that in which the curvature had thrown it, would be the one most likely to overcome the resistance of the ligaments, and to bring the displaced bones into their natural position. The means by which this point can be gained, I have endeavoured to shew in the following observations.

The plan of treatment I have to recommend, I believe offers a chance of being beneficial in a larger number of cases, than any that has hitherto been employed, and I am not aware that it has been practised before; it has been most successful in my own practice, so far as experience hitherto has enabled me to judge. I should not recommend it merely on account of any novelty it might possess, had I not convinced myself practically of the beneficial results to be obtained by its employment.

I have consulted most of the English works that have been written on the treatment of lateral curvature of the spine, and do not find that any of their authors have recommended the position of placing the patient on the side, in order to produce the lateral flexion of the spine, and thereby to overcome the resistance of the ligaments in the most effectual manner, at the same time that the ribs and vertebræ are brought out of their abnormal position, by the pressure that is made upon them. A French writer, M. Guerin, adopts the principle of lateral flexion, but by mechanical means only, applied in the horizontal position. He places the patient on the back, and fixes her to the couch by straps and buckles, and then moves portions of the frame-work in opposite directions, by means of

powerful screws. This position acts in a different manner and the principle also differs from the one I have recommended, believing that the weight of the head and extremities is quite sufficient to overcome the curvature, as well as being much less painful and irksome. I have, as a general rule, avoided all reference to the works of others, not wishing to deny that good results are obtained by adopting the treatment recommended in them, or to offer objections to the opinions they may contain, and with which I might not agree. Independently of such not being my wish, it would have increased the size of the volume, without adding either to its interest or usefulness; at the same time, I am anxious the reader should not think me careless with regard to what others may have written on the subject. I shall therefore give a general summary of the modes of treatment recommended in the various works that have been written by English surgeons; and this can be better done in a preface than in the body of the work. I shall consider them according to their date of publication, giving the title of each work, to afford a more easy reference for those who may desire to be more acquainted with them.

Mr. BAYNTON, of Bristol, published in 1813, "*An Account of a successful method of treating Diseases of*

the Spine, with Observations and Cases in illustration."

He treats principally of caries of the vertebræ, advocating rest for a long period in the horizontal position, on a couch made specially for the purpose. He says little or nothing on lateral curvature, recommending the use of the left arm only in slight cases, and the recumbent position in severe ones: no detail of treatment is given.

MR. COPELAND.—“*Observations on the Symptoms and Treatment of the diseased Spine, more particularly relating to the incipient stages, with some remarks on the consequent Palsy.* 1815.” Treats of caries of the spine, but does not refer to lateral curvature.

MR. SHELDRAKE.—“*A Treatise on diseased Spine and on distorted Spine, with Cases to illustrate the success of a new method of cure.* 1816.” Treats both of caries and lateral curvature: for the former he recommends an instrument of his own invention to support the head, by the chin and occiput; for the latter, extension on an inclined plane capable of being altered from the erect to the horizontal position, with the use of the instrument also.

MR. WILSON. — “*Lectures delivered at the Royal College of Surgeons of London, on the diseases of the Bones and Joints.* 1820.” Treats of lateral curvature;

advocates principally the employment of muscular exercise, chiefly applied to the muscles of the back, by making the patient carry a weight on the top of the head. He thinks the horizontal position may do some good, but does not recommend it strongly; and condemns all instruments that are made to act from the pelvis.

Dr JARROLD.—“*An Enquiry into the Causes of the Curvatures of the Spine, with suggestions as to the best means of preventing, or when formed of removing the Lateral Curvature, 1823.*” Considers lateral curvature to depend on constitutional causes, and treats it on this principle, also by muscular exercises, by carrying a weight upon the head. His constitutional remedies consist of burnt sponge and carbonate of soda, by which alone he states to have cured many cases.

Mr. BAMPFIELD.—“*An Essay on the Curvatures and Diseases of the Spine, including all the forms of Spinal Distortion, 1824.*” For the lateral curvature recommends a variety of muscular exercises, extension of the spine by forcible pulling on the arms and legs, friction, and shampooing, and the use of machines to swing the head.

Dr. DODS.—“*Pathological Observations on the Rotated or Contracted Spine, commonly called Lateral Cur-*

vature, 1824.” Objects to spinal apparatus and to the inclined plane, also to the practice of carrying weights upon the head; he recommends friction, manipulation, position, and exercise. The position he employs is that of placing the patient on the back on a concave couch, to bend the whole spine forwards, “and relaxing the spinal muscles.”

Mr. JOHN SHAW.—“*Observations on the Causes and Early Symptoms of Defects in the form of the Spine, Chest, and Shoulders*, 1827.” Recommends extension on a couch of his own invention, placing the patient on the back, and then by weights, acts upon the upper and lower half of the body, the lower part of the couch sliding downwards from the upper, being made to run on rollers and wheels. He also recommends both muscular exercises and supports for the spine as part of the treatment.

Dr. EDWARD HARRISON.—“*Pathological and Practical Observations on Spinal Diseases*, 1827.” Treats principally of angular projection, caused by the displacement of one or more vertebræ, for which he recommends friction of the spine, combined with pressure against the projecting vertebræ, and the horizontal position on a firm mattress. Does not mention any special treatment for lateral curvature.

MR. STAFFORD.—“*A Treatise on the Injuries, the Diseases, and the Distortions of the Spine*, 1832.” Recommends the horizontal position, combined with exercises at the same time, employed in a manner to act upon the spine laterally. He also advises the use of spinal supports, such as are best adapted to this description of deformity, but does not specify any one in particular.

MR. BEALE.—“*A Treatise on the Distortions and Deformities of the Human Body, exhibiting a concise view of the Nature and Treatment of the principal Malformations and Distortions of the Chest, Spine, and Limbs*, 1833.” Recommends friction generally applied, instruments in certain cases, exercises, and mechanical extension.

MR. COULSON.—“*On Deformities of the Chest and Spine*, 1839.” Objects to all kinds of “collars and other machines,” recommends “suitable exercises.”

MR. WARD.—“*Practical Observations on Distortions of the Spine, Chest, and Limbs*, 1822 and 1840, *Second Edition*.” Objects to the use of mechanical supports, recommends the employment of the recumbent position, not however to be relied on as the sole means; thinks most benefit is to be derived from the exercise of the muscles, and principally those of the spine and head.

Mr. TUSON.—“*The Cause and Treatment of Curvature of the Spine, and Diseases of the Vertebral Column, 1841.*” Advocates principally the recumbent position, on a couch of his own invention, admitting of muscular exercises at the same time.

Mr. CHARLES ROGERS HARRISON.—“*Deformities of the Spine and Chest successfully treated by Exercise alone, and without Extension, Pressure, or Division of the Muscles, 1842.*” As the title of his work explains, relies only upon exercise of the muscles.

Mr. HARE.—“*Practical Observations on the Prevention, Causes, and Treatment of Curvatures of the Spine, 1844.*” Recommends a couch of his own invention, acting on the principle of extension by means of pullies and weights.

Mr. COLES.—“*Spinal Affections, and the Prone System of treating them, 1845.*” Recommends the prone position, placing the patient on the chest and abdomen, also the exercise of the muscles of the spine and upper extremities. L

Mr. TAMPLIN.—“*Lectures on the Nature and Treatment of Deformities, 1846.*” Recommends the employment of mechanical support by means of the instrument he has invented, and to which I have referred in the course of my observations, he condemns the horizontal position and all kinds of couches. L

I have given the general principles of the treatment recommended by eighteen different authors. The majority are in favour of the recumbent position, either supine or prone, combined with efficient exercise of the muscles. They all, with one exception, attach no further importance to spinal supports, than as mere agents to take the weight of the head and shoulders off the spine ; they are not supposed to possess any power of actively overcoming the deformity, by mechanically moving the spine in a direction the opposite to that in which the curve has thrown it. The principle of extension, by placing the patient on her back and acting by weights and pulleys, adapted to couches of various kinds, appears to have had the largest number of advocates. The plan I have to recommend is quite opposed to this, advocating the position that produces lateral flexion as that best adapted to straighten the spine, believing it to be the most effectual as well as the least tedious and irksome, owing to the short time it is required to be employed, to render the ligaments gradually more yielding, and to enable the pressure of the instrument that is afterwards to be applied to act with greater advantage.

82, Guildford Street, Russell Square.

March 25th, 1847.

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GENERAL OBSERVATIONS
ON THE
CAUSES AND SYMPTOMS
OF
LATERAL CURVATURE OF THE SPINE.

SIMPLE lateral curvature of the spine, unaccompanied with disease of the bones or ligaments, is a very common affection, and may be said to be almost peculiar to females. So common is it, that were it practicable to examine the spines of all those who are above what is called the labouring classes, I believe we should find in by far the majority of them, some deviation from the natural erect line, causing a greater fulness on the right than on the left side, both in the ribs and shoulder; it may be so slight, however, as not to be perceptible with the dress on, and therefore escapes observation. Lateral curvature is sometimes met with in males, but then it is found to depend on different causes, being secondary to some other complaint,

such as lameness from disease of the hip, scrofulous disease of the vertebræ, rickets, or some inflammatory or other affection within the chest ; whereas in the female it may be altogether a primary affection, the girl being in good health at the time of the curvature commencing, and having had no previous disease to which it can be traced. In these cases, it may be said to be a simple weakness of the spinal column, owing to deficient strength in the ligaments connecting the vertebræ together, and to a want of muscular power to preserve them in their natural relative position ; both of which place the spine in a condition to be easily acted on by causes which tend, either by the increased muscular power, or by the mechanical weight of the body being unduly balanced, to throw the vertebral column to one side more than the other.

It is not so easy, as it may at first sight appear, to account for the lateral curvature of the spine occurring so much more frequently in the female than male. A general explanation may be given no doubt, by referring to the different occupation of boys to that of girls. Boys being in constant exercise, using both arms equally ; in fact, never while in health being placed under circumstances which bring the spine into the curved position for any lengthened period. The reverse however is

the case with the majority of girls; they seldom take much exercise, and rarely or never to the same extent which boys do; they frequently remain in positions that throw the spine out of the erect line for a length of time together, and what is worse still, the same positions are repeated day by day, and so the deformity begins almost imperceptibly; in fact the awkward or unnatural position then becomes the easier, owing to an effort being required to keep the spine erect, which is irksome and therefore not exerted. In some cases the cause may be traced, and perhaps in many the origin of the curvature may be satisfactorily explained by referring it to some long-continued position that throws the spine to one side more than the other. But there is a large number of cases where all traceable causes are absent, where no awkward position of the body has been employed; where there has been no mechanical pressure from stays, no disease of the vertebræ nor within the chest, and apparently no constitutional debility; and yet there is found to be a curvature of the spine to one side, in many cases it may be only slight, but in others to a very marked extent. In these cases I say it is often very difficult to trace the cause.

Again, the curvature is almost always found to

be towards the right side,* it is the exception (and it is met with) for it to be towards the left. The consideration of this point possesses some interest, and will be found to depend on many circumstances, of which I should offer the following explanation; it however will not be found satisfactory in all cases.

In the first place, as a general rule, (and I am now speaking not only of the higher classes of society, but of all those who are not employed in physical labours, requiring great muscular exertion, for when so employed women exercise the muscles relatively as much as men, and therefore become proportionably strong,) girls lead a more sedentary life than boys;—they are occupied for hours together in the same position, and this one which throws the spine out of the erect line. This may be illustrated by a very simple and very common example. Observe a girl at her needle—she sits for hours together with the head hanging forwards; the left arm is but little used, and drags the shoulder of this side downwards, and tends to make the chest of the left side contracted, by weighing and pressing

* By the term “curvature to the right side,” I mean that the spine is thrown over to the right, the projection being in that direction. The concavity of the bend is of course to the left.

on the ribs ; in fact the muscles of this side of the body are not called into action, for they are not required : one half of the trunk then is comparatively passive. The reverse, however, is taking place on the opposite or right side of the body. The right arm is in constant use, being principally employed in a position before the chest, the weight of the upper extremity is taken off the ribs, both by the pectoral muscles, as well as by those muscles which raise the clavicle and scapula. These circumstances favor the curvature of the spine to the right side in two ways : first, they increase the expansion of the right side of the chest, by giving freer motion to the ribs, and second, the opposite or left side becomes gradually more contracted, owing to the dead weight which is thrown upon it, from the arm being so little used and constantly dependent. Combined with these, there is another and internal cause acting, viz. : the greater expansion of the lung on the right than on the left side, owing to the pressure on the ribs, and to this I attach much importance, where the above position which I have been describing is continued for a length of time : for although it may act but slightly at first, it will tell in an increased ratio when the two sides of the chest become materially altered in size, for the less respiration there may be in the left

cavity of the chest, the greater duty the right lung will have to perform, and necessarily increase the expansion or convexity of the ribs and the convexity of the spine, at the same time, on the right side, which is the curvature I am now considering. If this be a correct explanation of the manner in which the curvature may sometimes commence, it is easy to see how, when once begun, it may go on rapidly increasing, till those frightful deformities are produced which are so often met with, where we find the ribs on the left side so much compressed that but little air can enter the lung, and the heart itself becomes pushed to the right side of the sternum; in fact almost the whole function of respiration is performed by the right lung in these extreme cases of deformity; or if by the left at all, it is pushed completely over to the right of the median line of the body. I am not aware that the irregular expansion of the lungs in the two sides of the chest has been before advanced as a cause tending to produce, or to increase the curvature after it has once commenced. I think I am not wrong in stating it as one of the causes, and that it acts in the manner I have related above. That the want of expansion in one lung, and consequently of the ribs of the same side, is a cause sufficient to destroy the natural balance of the spine, is seen in cases of collection

of fluid within the chest, in Empyema or Hydrothorax: where, if the patient survive the disease after the evacuation or absorption of the fluid, and the lung do not recover itself, the ribs become contracted on this side, and the spine is thrown over to the opposite, causing a curvature in that direction.* I would ask further, (and the question is I think more than hypothetical,) may not the original normal difference in the size of the two lungs, the left containing less air than the right, predispose the left side to be more easily acted on by causes which tend to produce constriction of the chest, independently of any position the body

* Since writing the above, I have seen a Lecture by Sir Benjamin Brodie, supporting this view. He says, "Another cause of lateral curvature of the spine is a difference in the capacity of the two sides of the chest. Hypertrophy of the heart, or a diminution in the size of one lung, will produce the same effect. I was consulted concerning a little girl, in whom there was an unusual degree of this kind of distortion. On examination I found that she breathed with one lung only, and that the other side of the chest was reduced to a very small size, the ribs lying almost in contact with each other. The fact proved that two or three years before the period of my being consulted, she had suffered from a severe attack of pneumonia, in consequence of which, the organization of one lung had been completely destroyed so as to render it altogether useless, respiration being performed wholly by the other."

may be placed in, which, under other circumstances, might be the principal cause.

Constriction of the ribs by stays, or tight lacing as it is called, is by most writers advanced as a cause of lateral curvature of the spine. The fact is stated, though I am not aware that any satisfactory explanation has been given as to the mode in which it acts. Admitting that stays, when tightly laced, are sometimes, or even often, the cause of curvature, why should the curvature be so frequently to the right side as to make it the exception only when it is met with on the left. The view I have above taken with regard to the difference in the size of the two lungs, I would venture to advance as one of the causes. Take the following case:—A girl is in good health up to the age of ten or twelve years, the whole body grows and is little confined by the dress she wears; the spine is found to be erect and the chest expands equally on both sides; the lung of the left side, though less in capacity than the right, is still sufficient to press against the internal surface of the ribs, and to preserve the symmetry or normal condition of the thorax. She now, either from the erroneous opinion that the beauty of her figure can be improved, or from the more innocent feeling of wishing to imitate others—if the foolish fashion be prevalent—closely confines

her body in stays ; if not to the absurd extent to produce what is called a small waist, to an extent far beyond what nature intended. What takes place then is the following : the stays may be so well made that they appear to fit the shape perfectly ; no pains may have been spared in this respect, and all the intentions put forward by the makers in their advertisements may have been realized, from the simple stay-maker up to the so-called hygienic or orthopædic manufacturer of corsets. But how do they all act, and what is the object of them all ? They compress the ribs and diminish the size of the waist. The evils whereof I have now to state, and the manner in which these evils are produced.

This constriction at first may not be great,—the figure will not bear it ; for a while no evil occurs ; the pressure however is increased by degrees, by lacing the stays gradually tighter and tighter, by which means they may after a time appear to be too large, owing to the diminution which they have produced in the size of the thorax. They may then have to be taken in to fit the figure more closely, and this may have to be repeated again and again, occupying, I admit, a long period of time ; it may be one, two, or three years, but the end is ultimately gained, viz., the small waist,

and the normal size and shape of the chest are reversed ; the lowest part, which ought to be the widest, has been made the narrowest. This is no exaggeration ; for the skeleton shows it ; every surgeon must have seen it during his dissections ; but dissections are not required to prove it, for the examination of the living body is often sufficient to make this abnormal difference quite apparent. This altered shape and compression of the ribs are not all ; there is found in many if not in the majority of cases the deformity of which I am now speaking, viz., the curvature of the spine to the right side, in some only to a slight, but in many to a most severe extent.

The constriction of the stays at first tells equally on both sides of the chest ; but will it continue to do so after being allowed to act for a length of time and in an increasing degree ? I say, no ; for the simple reason that the ribs on the two sides do not offer the same resistance, owing to the difference in the size of the two lungs ; the left side of the chest contains less air than the right, which it must, owing to the left lung being smaller than the right. Combined with this, there is the position of the liver on the right side to be considered, to which I shall refer again, as a cause tending to support the right side of the chest, and

to render the ribs less liable to compression on this side than on the left. The constriction, then, produced by the force of the stays, must act more on the side where there is the less resistance, and this, as already stated, is the left ; the consequence of which is, that the ribs of this side will become more compressed, and the capacity of the lung be also diminished.

The deformity is thus begun, slight at first, but quite sufficient to lay the foundation for its rapid increase ; for, as already stated, the less the capacity of the left lung becomes, the more duty the right has to perform ; or at any rate its normal capacity is kept up, from its greater power of resistance, while that of the left is being diminished. One great cause, then, is established, if not (as I think in many cases it may be) of originating the deformity, at any rate of increasing it. I trust this view I have taken of the mode in which stays act in producing the first step or stage of the curvature may not be thought irrational ; and if not, it will be easily seen how it may continue to increase it, and so lay the foundation for other evil effects arising from the same cause.

But the mischief goes on ; the more the left side of the chest is pressed in, the tighter the stays have to be laced, to keep the shape of the figure

(as it is thought), as well as to give the trunk support, which the girl feels she requires, and in fact cannot now do without ; the consequence of which is, the ribs become doubled down more and more, till their edges are in contact or even overlap each other. How the lung on this side of the chest must become compressed, and how all support must be taken from this side of the spine, must be so apparent, that no detailed illustration need be given. The important point I wish to have borne in mind, is, the absence of support from the above cause, on the side of the spine on which the ribs are so compressed.

Any long-continued position of the body, which places the spine under circumstances to bring the weight of the arms and head to bear more on one side than the other, will throw it out of its normal erect line, causing an unequal strain upon the ligaments, at the same time that the muscles of the back are but little brought into action ; there is nothing then to oppose the mechanical weight acting unfavourably on the vertebral column, and the spine begins to yield laterally, at first only in a slight degree, but by long continuance soon increases to an extent, that the weight of the head and shoulders, even by themselves, in the erect position, is sufficient to cause the curve to become

more and more decided; though the girl may no longer be placed under the unfavourable circumstances of pressure from stays, or of remaining in the awkward position which at first caused the curvature to commence. The mischief has been done by the normal straight line of the spinal column having been destroyed; the equal balance of the two sides no longer exists, the muscles of the back no longer poise it in the erect position; in fact, after the curvature has once commenced, the muscles may be and often are one of the principal causes tending to increase it; a point I shall again refer to.

The most common positions which act mechanically to throw the spine out of its erect line are the following:—all sedentary occupations continued for hours together, where the position is little varied, such as needle-work, to which I have already referred; writing at a desk, with the right arm raised at a higher level than the left; reading, the posture employed being that in which the book is held or supported with the left hand, the arm of this side being dependent, while the right is raised and brought before the chest. The position of girls at some schools, where they are what is called “kept close to their studies,” or, in other words, are made to continue in the same posture for hours

together, and this, one, as I have already stated, which chiefly employs the muscles of the arm of the right side, while those on the left are comparatively passive, causing a dead weight to be thrown to this side, and to drag and press constantly against the ribs. There is an occupation in which many girls are employed in the trade of book-binding, namely, what is called book-folding; to this I have in many cases traced the commencement of the curvature; the cause is the same as that I have mentioned above, viz., the employment of the right arm more than the left, which this business necessarily requires. Many girls have an awkward way of standing, bearing almost all their weight on the left leg, a position which throws the right shoulder up and causes the left to drop. I am not sure however whether this position is not often, if not always, secondary, and is practised after the curvature has commenced, though unobserved by the parents or by the girl herself, rather than a primary cause of the evil; though no doubt the constant position of resting the weight on one leg more than on the other, will throw the spine out of the straight line, when it becomes a habit of long continuance, and may then be a cause of curvature.

Carrying children on one arm principally, and

this is generally the left, is a very common cause of lateral curvature when practised for any length of time, as is the case with nursery-maids. Daily observation will illustrate this, if the position of the spine is remarked during this occupation. The shape of the dress shews it externally by the twist it takes to the right side, as well as by the right shoulder being so much fuller and higher than the left. In private families, girls of ten or twelve years of age, or even older, are often seen nursing their younger brothers or sisters, if infants, and carrying them for long periods together daily, on the left arm principally. The practice is most injurious, and cannot be too much condemned, and, I am convinced, is often a cause of commencing the curvature. The manner in which it acts is easily understood. The weight of the child requires that the centre of gravity should be preserved, in order to carry it with ease: to do which, the spine is thrown over to the right side, and the greater part of the weight is borne on the left leg; the pelvis, at the same time, is placed obliquely, and the right hip rendered prominent; independently of which, there is the weight of the child pressing the arm against the ribs of the left side, and tending to depress them.

In all the cases which I have been mentioning,

the curvature may commence independently of any constriction of the ribs caused by stays. It is position only, which primarily throws the vertebral column out of the erect line.

It is unnecessary to enter into further consideration of the peculiarities depending upon position, as causing curvature of the spine: since, as a general rule, I believe it may be stated that any position, where the right arm is used more than the left, the equipoising of the vertebral column being lost, will throw the spine to the right side, and will be sufficient, by long continuance, to lay the foundation for the lateral curvature. The other cause to which I also attach much importance, and have endeavoured to explain, being the constriction of stays, or some other part of the dress which forcibly compresses the ribs.

The points which have been considered above, refer more particularly to the proximate or immediate causes which produce the lateral curvature of the spine; there are one or two others which I think worthy of some attention, and which may be considered as remote or predisposing causes, as tending to produce the curvature to the right rather than to the left side. My object now is, to endeavour to trace the origin of those cases of curvature, where the history, if it can be depended upon,

leads us to suppose that none of the above causes, such as awkward positions, confinement of the ribs by stays, &c., have existed. The parents of the girl, or the girl herself, will tell you, that she has never been employed in occupations which have required her to be in one position for any long-continued period; that she has never carried children in her arms, and has never worn tight stays; still there is found to be an inclination of the spine to the left side, producing the common curvature to the right. The girl is apparently in good health, and may never have had any illness; how then is the curvature to be accounted for? The only cause the parents can think of or refer it to is, that she has grown too fast; she is said "to have out-grown her strength." To consider this point, then, next; the real explanation, or the most probable one, that can be offered in these cases, is, that the spine, with the rest of the skeleton, grows to an extent without the muscles increasing in strength in a ratio to give them sufficient power to poise the vertebral column in the erect position. The ligaments, at the same time, which connect the vertebræ together are wanting in strength also; the spine is flexible in the lateral direction, causing it to yield easily on one side or the other from the simple weight of the head or movements of the

upper extremities, independently of any of the causes already mentioned, such as long-continued or constrained positions, &c., &c. The spine, in fact, is too weak to bear the weight of the trunk and upper extremities. But here again the question arises, why should it yield on the left rather than on the right side? why should the ribs on the right side expand, causing the right shoulder to be higher than the left, while on the left side the ribs are compressed, causing the shoulder to fall from want of support? The causes already mentioned may in some cases tend to produce this, but there may be another cause also, which I will now refer to as a probable one, and acting in all cases. There is a natural or an acquired disposition to use the right side of the body more than the left; I would almost say it is a natural one; most people are what is called "right handed:" all the muscles are more developed and possess greater power on the right than on the left side of the body, more particularly those of the upper extremities. This is less marked in females than in males, for the simple reason that they are less employed in physical exercises or occupations which tend to increase the muscular development; but still, though less marked, this difference will be found to exist, both in the more frequent use of the right arm, as well

as in its greater size. The muscles which move the right arm upon the chest gain increased power at the same time. The ribs of this side are more acted upon; they expand the chest consequently to a greater extent and give greater effect to the cause I before laid much stress on and repeat again, viz., the freer play of the lung of the right than of the left side; the consequence of which has been already stated, viz., that a mechanical dead weight is thrown on the left side, tending as it were to drag or bear the spine down in that direction, quite sufficient in my opinion to produce the curvature, which, when once commenced, may go on rapidly increasing.

I would ask the question, may not the liver, from its position, give a degree of support to the under surface of the ribs of the right side, sufficient to cause a difference in the resistance of the two sides of the thorax? Does it not mechanically, to a certain extent, prevent the ribs from being depressed, while on the left side no such support or resistance exists? Let any one stand in the erect position, and try to flex the spine laterally, he will find he can do so with much greater facility and to a far greater extent on the left than on the right side. May not this be owing to the presence of the liver on the right, and to its absence on the left side? It may be said, that the liver will be de-

pressed, and so the opposition removed. I believe it will not; for any movement of the spine which bends it to one side or to the other, is principally produced by the action of the abdominal muscles; they necessarily press against the viscera at the same time, and so oppose the displacement of the liver; and not only oppose it, but in extreme action tend to press it upwards. If so, it is quite intelligible how the liver must give support to the under surface of the ribs, with which it is in contact.

If this be true, the absence of the liver on the left side, depriving the under surface of the ribs of the support those on the right receive, renders them more easily acted on and compressed than the right, and at the same time throws the spine over to the right side.*

Supposing the above to be a reasonable explanation of the mode in which the increased use and development of the right arm more than the left, acts as a cause to commence the curvature, it is not the only one that tends to increase it; for the muscles of the back themselves may become a very powerful agent in drawing the spine more from its natu-

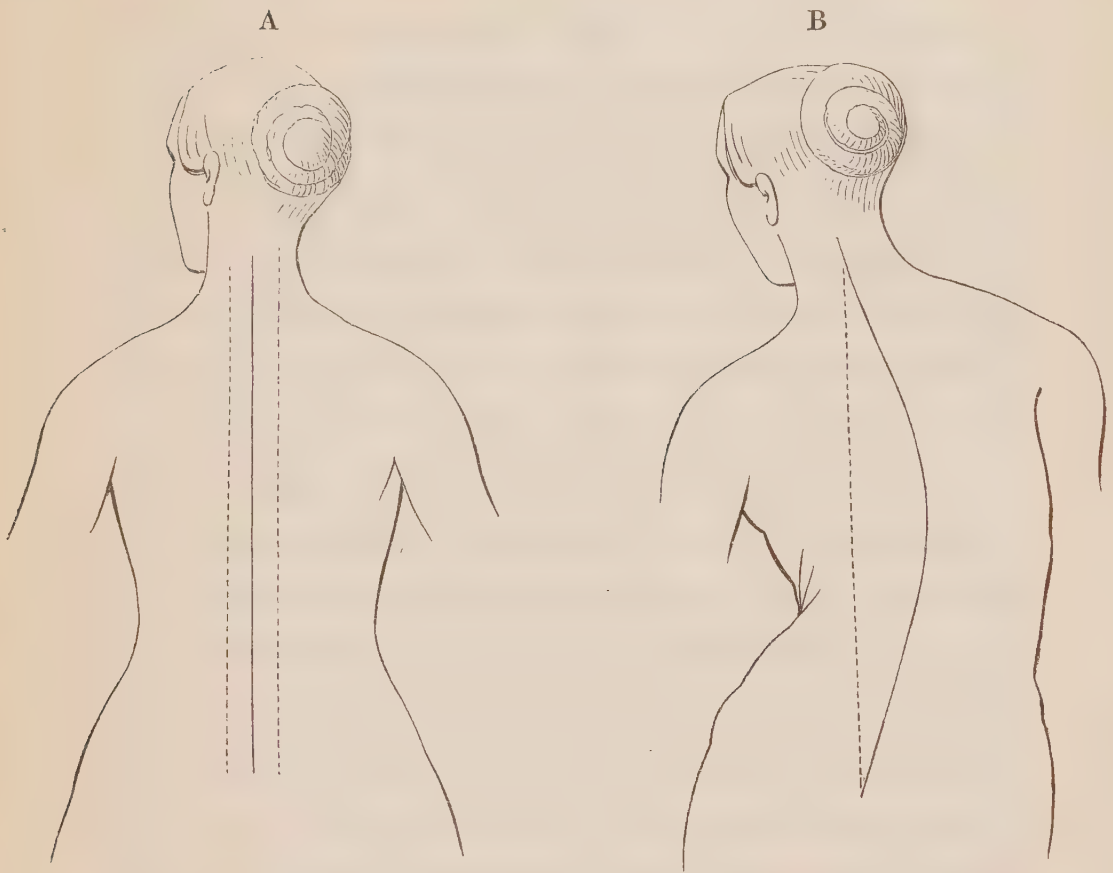
* I would also ask, may not the fact of this position of the liver being on the right side, be a cause of giving more support and strength to the right side of the chest, and so give a predisposition to the employment of the right arm rather than of the left?

ral erect position. And here I may state, contrary to the generally-received opinion, that I do not think the muscles proper to the spine and ribs take any part in the original production of the curvature, for there is no evidence or reason to suppose that the muscles on the one side are weaker than on the other, though they may both be generally so and less developed than natural. The girl may be generally weak, but why should one set of muscles on the one side have less power than on the other? The effect we should expect to see, would rather be a general inclination of the spine forwards, producing a curve of the whole vertebral column in that direction, the convexity being backwards, and not to one side more than to the other. But the curvature having commenced, circumstances are altered, and the following explanation I would offer of the effects which now take place.

It must be borne in mind, that the large and powerful muscles which keep the spine erect in the healthy condition, lie in the deep groove on either side of the spinous processes of the vertebræ, extending the whole length of the column; they may be said to lie parallel to one another, their line of action being equal on both sides, whether on the vertebræ only, or upon the ribs to which many of them are attached; and telling downwards from

the head to the upper and posterior part of the pelvis. So long as the spine keeps its erect position, they keep the same line of action, and balance one another. But supposing a curvature to be produced from any of the above causes I have mentioned, and its situation to be within the upper half or centre of the spine, where it generally commences, what effect will these muscles have upon the vertebral column? Will they tend to redress the curve? Is there a tendency for the set of muscles on one side of the spine to act more than on the other? I believe not. They both continue their action simultaneously, even after the curvature has commenced, and only tend to increase it. The general line of action with regard to the direction of the fibres of the muscles remains the same, but they affect the spine differently now that a curve exists. I would explain this by the two following diagrams, A and B.

The straight line in the diagram A, represents the spinal column in the natural erect position. The dotted lines represent the situation of the muscles on either side of the spinous processes of the vertebræ, acting upon the ribs as well as on the vertebræ themselves. The action of these muscles tells equally on both sides, and the spine is balanced in the median line, there being, as already stated;

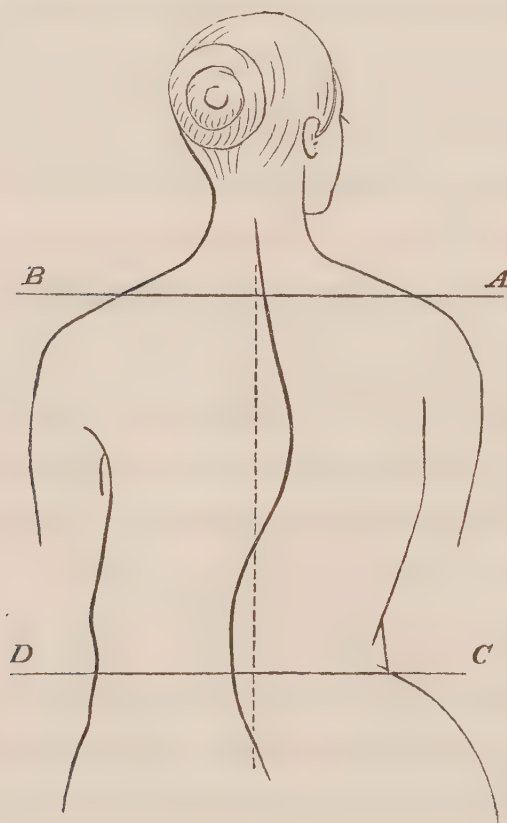


no disposition for the one set to act more than the other. But supposing a curvature to exist, and the spine to be thrown towards the right side, as in diagram B, the muscles on the left side continuing to act from the upper to the lower part of the column; they are then similarly placed to a string acting upon a bow,—the more they pull, the more they tend to increase the curve, and to throw the convexity to the right side. But this is not all; for after a while the muscles on the right side towards the lower half of the spine lose their pro-

per relative position to the vertebræ, and are thrown towards the left side of the spinous processes, and become similarly situated as regards their action to the muscles proper to the left side, and will produce the same effect on the curve, namely, tend to increase it. This altered position becomes more marked when the double or sigmoid curve is produced; when the whole mass of the proper spinal muscles is displaced in the lumbar region to the left side of the median line. This is one of the reasons why the right hip projects more than the left, the fulness on the left side of the loins being reversed by the mass of muscle being principally situated there, and little or none on the right side. The curvature of the lumbar vertebræ also has much to do with it, the convexity being the reverse to that which is found in the upper or dorsal region, causing a hollowness to exist above the right ilium.

I have referred, in the above paragraph, to a second curve; this however does not always exist, for there are many cases where the simple curvature or bow to one side only is present. When the second curve is produced, it is found to occupy the lumbar region. It may be called the compensating curve, for it acts by preserving the centre of gravity of the head and trunk; though no doubt it may be

said to increase the deformity, it is still a provision of nature ; and the fact is, that in those cases in which it exists, there is less apparent curvature than in those in which there is only the one curve to the right side ; for the one shoulder does not then drop so much below the other. The two shoulders may appear to be almost on the same level, though the right may project more posteriorly, owing to the increased convexity of the ribs. In the diagram it is shewn how this may exist, there is however the greater prominence of the right hip for the reasons already explained.



The horizontal line AB represents the level of the two shoulders. The line CD the level of the hips ; the right projecting, owing to the spine having receded from it. The dotted line marks the centre of gravity, preserved by the lumbar or compensating curve.

There is sometimes a third curve, situated in the lower cervical and upper dorsal vertebræ, caused by the action of the muscles to keep the head in the horizontal position : this is not common however, and is chiefly found in those cases where there is great debility of the system generally, producing weakness of all the ligaments and muscles of the spine throughout its whole length, combined with which, there may be a projection posteriorly of the dorsal portion, causing the spine to be twisted on itself.

These, then, are the principal causes of the lateral curvature of the spine, which I shall briefly recapitulate, and which may be stated under three heads, viz., 1st. The predisposing causes ; 2nd. The proximate or immediate causes ; 3rd. The super-added causes, increasing the curvature when once commenced.

The predisposing causes are, general debility of the system, producing weakness of the muscles and ligaments, the deficiency in strength showing itself

more readily in the spine than other parts of the body, owing to the peculiar structure of the vertebral column and to the great weight it has to support; circumstances which render it liable to be easily thrown out of its natural erect line. The difference of the pressure internally on the two sides of the thorax against the inner side of the ribs, the left lung containing less air than the right, being smaller in size, while the ribs on the right side receive support also from the liver being pressed against them; two causes on which I am inclined to lay much stress, and which I also think give a predisposition to use the right upper extremity rather than the left.

The proximate or immediate causes are, any position which throws the spine out of its natural line continued for a length of time, without there being active muscular exercise employed in the intervals to redress any deviation that may have been produced, so that by degrees the deformity slowly and imperceptibly increases. Sedentary occupations, in which the right arm is used more than the left, whether at needlework, or during the close application to studies of various kinds, such as reading, writing, or drawing at a desk or table, while the right elbow is supported and the scapula thrown upwards, at the same time that all the weight is

taken off the right side of the chest and its expansion allowed to be more free, during which the head is thrown to the left side, the left arm is allowed to hang at a lower level, is little used, causing a dead weight to press against the ribs, as well as the position itself throwing the central or dorsal portion of the spinal column over to the right side, and causing a concavity on the left. Carrying children, which is often done by the better classes of society, where the girl has younger brothers or sisters as infants, as well as by those whose almost sole occupation it is, namely, nursery-maids. Standing constantly in a position which throws the weight of the body more on the left leg than on the right, will bring more strain on the lower or lumbar portion of the spine, and cause the mechanical weight of the head and shoulders to bear the central or dorsal portion towards the right rather than the left side. Finally, tight-lacing, or without being tight, an unnatural degree of pressure by stays or whatever the nature of the dress may be, when exercised against the ribs and spine while the girl is young and growing, will for the reasons already mentioned, namely, the less resistance of the lung on the left side, as well as the support the right side of the chest receives from the liver, combined with the increased strength

and more constant use of the right arm, be a sufficient cause in many cases to commence the curvature and in most to increase it.

The superadded or increasing causes, and which are perhaps more decided and explicable than the former, are, the mechanical weight of the head and upper extremities, which tell daily and hourly to throw the spine more out of the perpendicular line when the curvature has once commenced. Awkward positions, both in sitting and standing, which now are employed by the girl to give herself relief, as well as being instinctively prompted to do so, to balance the trunk, and unconsciously to compensate for the absence of the erect condition of the vertebral column, and so to preserve the centre of gravity, which unfortunately does but at the same time greatly increase the curvature.

Lastly, the muscles of the back themselves, continuing to act in a straight line from the upper to the lower part of the spine, tend greatly to increase the curve, more particularly the set of muscles on the left side, which draw the upper part of the spine towards the lower, as stated when explaining diagram B, p. 23, like a string acts upon a bow. The muscles also on the right side tend to increase the deformity, when there is a disposition for a second curve to be formed by the lumbar portion

occupying a situation to the left of the median line, and in severe cases, as already stated, this portion of the muscles may partially ride over or be completely displaced to the left side of the spinous processes of the lower vertebræ; placing them in a similar position with regard to their line of action to those proper to the left side itself, and acting in the same manner.

Having thus briefly explained the causes generally which produce the lateral curvature, (and here I must repeat I am only considering the simple form unaccompanied with rickets or structural disease of any kind,) I shall proceed to describe more particularly some points connected with the situation of the curvature, as well as the alteration in the shape and position of the ribs, as affecting the form of the thorax.

The general points to be considered, are, the situation and extent which the curvature may occupy; the alteration produced in the shape and outline of the thorax and shoulders; the altered position and action of the muscles; all of which vary much in degree, according to the severity and duration of the deformity. Lastly, which however it is not my intention to enter into at any length, there are the functional derangements to be considered; they are such as might be expected, viz.,

those depending on general debility, and those produced by the altered situation of the viscera, and the consequent interference with their natural functions.

The lateral curvature may take place in the dorsal portion of the spinal column only, or be accompanied with one in the lumbar region in the same or opposite direction. There is also sometimes a third in the cervical region. The lumbar curve seldom exists by itself without the dorsal, though it is sometimes said to be the first produced. Of this I have my doubts, without there be structural disease of the vertebræ or intervertebral substance, a class of cases I am not now considering. The same may be said of the curve in the cervical region; they are both, I believe, secondary to the dorsal, constituting what I have before called the compensating curve, to preserve the centre of gravity of the head and trunk, that is to say, when they take opposite directions, representing an italic *f* reversed.

The curvature in the dorsal portion of the spinal column, generally begins in the situation of the upper half or in the centre of that region, for this part admits of more lateral motion than the lower half, depending on the smaller size of the bodies and articulating processes of the vertebræ, as well as

from the circumstance of the upper ribs being those to which the superior extremities are principally connected. These circumstances favor the action of those causes which have been mentioned as tending most commonly to throw the spine out of the perpendicular line. If we take the instance of position, when the left shoulder is allowed to drop, while the right is in constant use and raised at a higher level, the stress comes at first upon the upper half of the dorsal region, but soon extends to the lower half as well; for the shoulder of the left side dropping, causes the clavicle to bear directly upon the first and indirectly upon the second and other ribs, and will by long continuance press them downwards; while, at the same time, there is the want of action in the muscles attached to them, whose office it is to keep them raised, namely, the *scaleni*, which are comparatively little exercised with those on the opposite side; combined with this, there is the dead weight of the whole upper extremity telling against this side of the thorax.

In many cases, the whole of the dorsal region yields at the same time, causing one general flexion of the spinal column; but then the upper half will generally be found to be the more curved.

While the above causes may be said to be mechanically depressing the left side of the thorax,

there are active causes existing on the right side, that tend to increase the curvature in the upper part of the dorsal region. It has been stated, that the right arm is in constant use ; all those muscles that are inert, or comparatively passive on the left side, are in a state of action on the right ; the clavicle and scapula are raised by the action of the trapezius and sterno-mastoid muscles, and thus the weight and pressure produced by the upper extremity, are taken off this part of the thorax. At the same time, the scaleni muscles on this, the right side, are in strong action and raising the upper ribs ; for the above displacement of the two shoulders, viz., where the left drops while the right is elevated, cannot exist without there being a tendency for the head to fall to the left side. To counteract this, the scaleni muscles on the right side are put into strong action, which then keep the cervical vertebræ and the ribs from falling, as before stated : the sterno-mastoid also produces the same effect, keeping the head erect, only it acts from the sternum and clavicle instead. Combined with these, are the diaphragm and abdominal muscles, which I conceive may become powerful agents in increasing the deformity, by pulling the ribs downwards, acting more particularly on the left

side, owing to the curvature of the spine favouring the influence of their action.

If the muscles be admitted as agents in producing, and more decidedly in increasing the curvature (which they must be), other muscles will also take part and act upon the upper portion of the dorsal region, namely, the rhomboidei; for they being inserted into the base of the scapula, and their origin being from the lower cervical and their larger portion also from the upper dorsal vertebræ, they will, when their antagonists on the left side are passive, tend to draw the vertebræ to which they are attached towards the scapula; since the scapula itself is thrown abnormally forward by the powerful muscles in front of the chest, as well as by the actual mechanical weight of the upper extremity being thrown to the side and front of the thorax.

In this, which may be called the first stage of the curvature, so little apparent deformity exists, that it is seldom noticed by either the girl or her friends; yet, upon close examination, the following difference in the two sides of the body will be observed. The level of the two shoulders will be found to be different, the left being lower than the right, though but slightly so; the scapula on the

left side will be flatter, while the right is not only generally more raised and prominent, but is more so at one point than another, viz., its inferior angle ; this part of the bone projects more than natural, depending I believe upon the whole scapula being raised so much, that its lower angle is removed from the embrace of the portion of the latissimus dorsi muscle which ought to pass over it : this portion of the muscle then loses its hold upon the bone, and its lower end tilts upwards and backwards from the thorax.

If the chest be carefully examined in front, the region of the pectoral muscles will be found to be flatter than on the right side ; the clavicle will be directed obliquely downwards, only very slightly so in this early stage which I am now considering, while that on the right side keeps its horizontal line or may be slightly elevated. If the girl have arrived at an age for the breasts to be developed, the right will be found to be fuller than the left, a circumstance often noticed both by the girl herself and by her mother, before the difference in the position of the scapulæ and shoulders is observed. If the spine itself be traced in this early stage, there will be found to be a curve towards the right side, the concavity being towards the left. There is another point of difference in the two sides of

the neck, more particularly observable when viewed from behind, viz., the width and fulness of the two sides, explicable by the muscular development being greater on the right than left side, and more particularly in the trapezius muscles; the one on the left side is smaller, and from being dragged down by the weight of the upper extremity, forms a straighter line, at the same time that it is flatter, and so causes this side of the neck to be narrower.

As yet, in this early stage of the deformity, the lower part of the spine or thorax is little or but slightly altered, and there is no apparent difference in the two hips; a circumstance which exists to a marked extent as the curvature increases and reaches a more advanced stage.

The above description includes the symptoms which are to be observed in the early stage of lateral curvature; they are so little apparent, however, as to be often overlooked both by the parents and by the girl herself. If any notice have been taken, it may be that a greater fulness has been remarked in the right than left breast, and that one shoulder has been observed to be a little higher than the other; as yet no notice is taken of the back, for the deformity being so little advanced, the dress at present is sufficient to conceal it. Sometimes it is observed that the girl is constantly pulling the dress

on to the left shoulder, from which it slips off; this circumstance is, by the parents, looked upon as a bad habit the girl has contracted, and is adduced as a cause of the deformity; whereas the reverse is the fact, it being a consequence, and is owing to the curvature already having advanced to an extent to render the left shoulder lower than the right: the dress on this side then loses its support and has a tendency to slip off, which induces the habit of constantly endeavouring to pull it on to the shoulders.

The curvature however, having once commenced, soon increases to an extent to be observable by strangers, as well as by the girl's parents and friends: the right shoulder is said to be "growing out." What however is now taking place, is merely the advancement of the first stage. All the symptoms are increasing; the spine itself, if traced, will be found to be more convex towards the right side, with a corresponding concavity towards the left; the spinous processes of the dorsal portion, and more particularly the central part, are found to occupy a situation nearer to the right scapula, which is made more apparent when the shoulders are drawn back forcibly with the hands; and as the curvature increases, they are felt to project less in this region, which depends on two causes; the first, the greater prominence of the angle of

the ribs, which causes the spinous processes to lie in a hollow as it were ; the second, the displacement of the muscles which takes place, and which causes them to overlap and to conceal them from view, as well as to prevent their being so easily felt when the finger is passed over them. In severe cases of lateral curvature, there is often, from these causes, a great difficulty in finding the spinous processes in the centre or upper part of the dorsal region, without the patient be made to bend the spine by stooping forwards.

As the curvature of the spine increases, the deformity and displacement of the ribs increase also ; those on the left side become more compressed and pushed downwards towards the ilium of the same side, while those on the right become more expanded, the space between each rib being also increased. If as yet no curve have commenced in the lumbar region, the left hip will be more prominent than the right, from the ribs generally being so much compressed, causing the hollow to exist above the pelvis, which makes the ilium appear more prominent than natural ; at the same time, the spine being generally thrown towards the right side, fills up the hollow above the right ilium, making it appear fuller than natural. The left shoulder drops more and more as the ribs become

more compressed ; the scapula also on this side lies flatter, and is concealed in the hollow produced by the sinking-in of the ribs ; the muscles diminish in size from want of use ; in fact, the whole of the left half of the trunk is smaller and more wasted, appearing to be less developed than the right. An additional marked symptom, when the body is viewed from behind, is, that the arm itself appears to stand out from the side, there being a much larger space than natural in the situation of the angle formed by the skin which passes from the scapula to the shoulder, constituting what is called the posterior boundary of the axilla ; this is of course to be accounted for by the receding of the scapula and ribs from the humerus. The reverse condition is found to exist on the right side, from the fact of the causes being reversed. The right shoulder is raised to a higher level and projects more posteriorly, owing to the ribs being more convex and rendered more prominent generally, as well as the portion of the thorax on which the scapula itself rests. The angle of the scapula is the most projecting part of the shoulder, owing to this part of the bone resting on the long ribs, which are the most convex. Another cause of this part projecting so much, is, that the upper portion of the scapula, at the same time that it is raised to

a higher level, is placed more forwards and outwards, being drawn into this position both by the action of the muscles on the anterior part of the chest, as well as by the weight of the upper extremity generally, which position tilts the inferior part or angle of the scapula upwards, or from the ribs. Combined with these causes, there is the altered position of the latissimus dorsi muscle, which in slight cases, as already mentioned, partially loses its hold on the angle of the bone, and in the severer cases of which I am now speaking, may slip altogether from it, no longer having a hold upon the bone, and consequently no longer bracing it down; and in some cases this portion of the muscle may lie beneath its angle instead of upon it, being an additional cause of its projection. In many cases, the angle of the scapula projects so much that the fingers can be easily passed beneath it, while on the left side it lies so flatly against the ribs that it can scarcely be felt, and is with difficulty grasped. The hollow of the axilla of the right side, instead of being increased, is diminished, owing to the thorax projecting so much towards the humerus, that the arm in place of standing off from the ribs, lies in contact with them, and occupies a position more anterior as well, there being a difficulty to bring the elbow backwards from the mechanical

obstacle it meets with, namely, the projection of the ribs.

The appearances observed on the anterior part of the chest, are such as might be expected from the circumstance of the above alterations, which have been described as existing on the posterior part. The hollow below the clavicle is increased on the left side ; the clavicle and acromion process of the scapula are much lower than on the right ; the outline of the shoulder is flatter and straighter ; the breast itself is smaller and situated lower down, and all the muscles are less developed, the pectoral muscles more particularly giving less support to the breast, and causing it to appear flatter ; the side of the neck is less full and straighter, both from the want of development in the sterno-mastoid muscle and in the cervical portion of the trapezius, which latter muscle forms the posterior boundary of the neck when viewed from the front ; it has the appearance of being dragged upon, which in fact it is by the weight of the upper extremity, that now receives no support from the ribs beneath. The appearance of the ribs does not present so marked a difference on the two sides, when viewed in front, as from behind, for the fact is, that the deformity which is produced is not so great on the anterior part of the thorax as it is on the posterior, for there is the

absence of the spine as well as the angles of the ribs, also the absence of the scapulæ, all of which become marked features and an index to the extent of the deformity which may exist on the posterior part. Still, however, in the advanced stage of lateral curvature, when the deformity is great, there is sufficient difference in the two sides of the thorax in front, to make the symptoms very apparent.

The ribs on the right side in front are more convex and prominent than on the left, from the same causes which exist to produce the similar conditions on the posterior part. The difference in shape is not so observable however as on the left side, where there is, as already stated, the extreme compression as well as displacement of the ribs downwards.

Although on the left side the upper part of the thorax is flattened and compressed, there is in extreme cases a projection towards the lower part, owing to the long ribs being so much depressed that they occupy the situation of the shorter ones, causing a prominence to exist which is more apparent when viewed in front than on the posterior part. This projection is indicated in the outline figure, p. 25, just above the situation of the left ilium.

These are the appearances which generally exist

in the lateral curvature, when situated in the dorsal portion of the spine; they vary in degree according to the extent of the curvature present: in the severest cases they may all be so increased as to produce the most frightful kind of deformity, while in the early stages, or where the curvature remains only slight, they may all still be traced, though they may not as yet be sufficiently marked to be apparent without the attention is specially directed to them.

When the lumbar curve exists, which, as before stated, is the compensating curve, to preserve the centre of gravity, there is in reality less apparent deformity than in the single curve, although there are two curves instead of one. The shoulders nearly keep their horizontal position, that is to say, the left, though lower than the right, does not drop so much. The ribs on the left side do not become so much compressed, nor the right so much expanded, consequently there is less projection of the right scapula; there is still however quite enough to make the deformity great; but I am now comparing these cases with those of severe curvatures, with the single curve only.

When the lumbar curve exists, it is always to the reverse side of the dorsal, and this is to the left side, owing to the dorsal being to the right. In these cases, the right hip is the more prominent,

while in the single curve it is the left that always projects. The reason of the right hip projecting in these cases of the second or lumbar curve, is evident, viz., that the lumbar portion of the spine is thrown over towards the left ilium, which causes a hollow over the right side of the pelvis, owing to the vertebræ being displaced to the left of the median line. Another appearance met with in these cases, where the second or lumbar curve exists, is a projection situated on the left side of the spine produced by the muscles. In severe cases, the large mass of muscle formed by the sacro-lumbalis and longissimus dorsi is found to be lying part on the spinous processes, while part is thrown over to the left side of the vertebræ. The tendency which these muscles will then have to increase the curvature, owing to their line of action being altered, has already been explained at p. 24.

This projection of the hip to the one side or to the other, is an important point to attend to, for it will as a general rule indicate the existence or not of the lumbar curve ; for I believe it will be found, that in the majority of cases where the right hip projects, the lumbar or compensating curve exists towards the left side, whereas if the left hip project, there will be found to exist the single curve of the spine to the right side only.

The third or upper curve when it exists, which,

as before stated, is not common, is found in the cervical portion of the spine; it is generally met with where the spine is very weak, and in tall persons rather than short. It produces no other deformity than the mere alteration in the shape of this part of the spine would lead us to expect, there being more fulness of the muscles on one side of the neck than on the other. The curve is to the opposite side to the dorsal, and therefore the same as the lumbar, the convexity being to the left, while that of the dorsal is to the right. I believe this cervical curve seldom exists without the lumbar one below; it balances the head by bringing the centre of gravity within the pelvis when the dorsal curve is very great.

With regard to the alteration which takes place in the shape of the thorax, a great deal of variation will be found to exist, depending both on the extent to which the curvature has advanced, as well as upon the direction it may have taken; by which I mean, that in cases of the single curve to the one side only, the ribs will be displaced in a different manner to that when the double or lumbar curve exists; which difference I shall briefly point out.

As a general rule, I believe it will be found where the single curve only exists, causing the curvature of the spine to be thrown over to the right

side, that the ribs of the right side become more bent at their angles, causing, in cases of long standing, an extensive projection in this situation, and one at all times difficult to overcome, and frequently one that it is impossible to remedy. The ribs become bent at their angles, while the bones are comparatively soft and yielding, owing to the manner in which the pressure acts upon them as this kind of curvature of the spine is increasing ; for in the single curve the whole of the ribs of the left side are depressed towards the left ilium, which cannot take place without drawing or dragging the sternum in the same direction, and bringing it nearer to the spine at the same time, and causing the antero-posterior diameter of the chest to be diminished. The ribs of the right side then become compressed from before backwards ; their curve is lessened by their natural angle being increased, owing to their original formation giving them a disposition to yield at this rather than at any other part ; the heads of the ribs being fixed to the vertebræ, while the long shafts of the bones give the force which is acting on them a lever power. This alteration in their shape may take place while the intercostal spaces between the ribs are being increased, owing to the expansion of the thorax generally, caused by the convexity of the spine being thrown over to the

right side, by which the vertical diameter of the chest is increased at the same time. On the left side of the thorax, the ribs are generally depressed and approximated to one another, owing to the line in which the force is acting, and to the curvature of the spine being in that direction; the length of the ribs, if anything, is increased, owing to their angles being diminished, and the whole of this side of the chest becomes contracted, from before backwards, as well as laterally and vertically.

In the double curve, where the lumbar exists with the dorsal, the right side of the thorax may be more diminished in size than the left, owing to the sternum being thrown over to the right side, altering its position with the spine, at the same time that the intercostal spaces are not so much increased as when the single curve only exists, although the angles of the ribs may be equally as great by the bones being so much bent at this point; the projection caused, however, may not be so apparent, owing to the ribs on the left side not being so much removed from their natural position.

With regard to the functional derangement, which takes place in the lateral curvature of the spine, it is not my intention to say much; as already stated, my object being, in the present treatise, principally to consider the treatment of

the deformity as it is met with, by doing which, if successful, any functional derangement which may exist, dependent thereon, will be removed. The symptoms, as might be expected, vary in kind and degree, according to the extent and severity of the deformity; yet this does not always follow, for I have seen most severe curvatures of the spine and the consequent deformity of the chest, exist with much less functional derangement of the system, either generally or locally, than might be supposed.

Interference with the respiration, from the altered size of the thorax; palpitation of the heart, from the same cause, as well as from its mechanical displacement and compression; disorders of the digestive and other organs, both primarily produced by the deformity, and secondarily through the general health having suffered and the strength having been impaired. In many slight cases, the health suffers little or nothing by the curvature; the local symptoms may be principally those of which the patient complains; pain in the right shoulder, fatigue on making slight exertion, owing both to the weakness of the spine, as well to the interference with respiration.

There is a symptom I would refer to, and one that most medical men must have met with in young women, namely, a constant pain in the left

side just below the ribs ; they must at the same time have found it, in many cases, difficult to account for, and by no means easy to relieve. In more instances than one, I have traced its existence to incipient curvature of the spine ; and would ask, whether this pain may not depend on the pressure against the viscera caused by the altered position of the ribs ? If so, it is an important point to bear in mind ; and it may always be as well in such cases to examine the spine, and to remove the pressure by applying support to this side of the trunk, if satisfied of the existence of the curvature, and of the probability of it being the cause of the pain complained of. The pain in this situation may also be produced by the awkward position of sitting for a long period, and of leaning over to the left side, without the existence of any permanent curvature of the spine ; it is to be relieved by discontinuing the sitting posture, and by taking moderate and regular exercise.

In the majority of cases of lateral curvature, the improvement in the health commences as soon as the weight of the thorax and upper extremities is removed from the spine, which may be effected either by artificial support, or by employing the recumbent position ; points to which I shall next refer, under the head of Treatment of Lateral Curvature. I

shall consider the subject under three heads : First—of mechanical support ; its advantages, and the best mode of applying it. Second—of the recumbent position ; recommending flexion of the spine, as the best means to overcome the resistance of the ligaments. Third—of muscular exercise ; pointing out the advantages it possesses when employed as an adjunct to the other two.

THE TREATMENT
OF
LATERAL CURVATURE OF THE SPINE.

THE first and most important question to ask, in treating lateral curvature of the spine, is, can all cases be cured? The honest answer will be, certainly not: at least all surgeons who have had much experience in treating the many varieties, and of seeing the different degrees of severity in which they exist, will have this conviction; though it is to be regretted, that there are those professing to treat these deformities, who boldly assert they can be; the consequences of which need not be dwelt upon, namely, the dissatisfaction they cause to their patients, and the discredit they bring upon themselves; by exciting hopes which in the end are not realized, and by the imputation of ignorance, if not of something worse, being attributed to them, for having held out prospects of a cure where none could be effected.

In no class of cases is the surgeon more required

to tell his patient how much relief can be given, than in the various kinds of deformities; at the same time, nothing is so easy to do, to one who has had experience in their treatment. Let it be honestly stated at the onset how much can be done, what amount of relief can be given; and much after regret will then be saved, both to the patient and to the surgeon. Fortunately much can be now done in spinal as well as in other deformities, owing to the rapid advance which has been made in this branch of surgery of late years. Of the numerous cases which formerly were considered incurable, and which were given up as hopeless, many can be completely cured, and most of them greatly relieved. Sufficient has been done to make us say that more will yet be done, but, at the same time, the line can be drawn as to what really can or cannot be effected; the knowledge we at present possess will indicate that line, and ought, if fairly and candidly used, to influence our judgment in forming the opinion we may be required to give.

The fact being, then, that all cases of lateral curvature are not curable, it remains to define their nature; to point out the peculiarities which exist in certain cases, and which render some incurable; some to admit only of partial relief, while in others a complete cure can be effected. I shall

endeavour briefly to explain these distinctions. Before pointing out the varieties, however, which indicate the difference in the result which is to be expected as to those cases which are incurable,—those which admit of more or less relief, and those which are quite curable; and before describing the different treatment to be adopted in each class of cases, I shall consider briefly the general principles which are to be borne in mind; not entering upon the various plans which have hitherto been adopted; not advocating or condemning the treatment of others, which may or may not appear to be formed on fair and reasonable grounds of success; this is not the object of the present short treatise: all I wish to do, is to state my own views, and to recommend a plan which I have found beneficial in my own practice.

To treat the question of the cure of spinal curvature upon sound and scientific principles, we must, as in all other diseases, ascertain the causes and the effects produced; these I have already pointed out, and their consideration will have indicated the condition of the spine and thorax generally, likewise the obstacles that have to be overcome to effect the cure. The question resolves itself into these points: First,—there is weakness of the vertebral column; it has then to be artificially supported.

Second,—there is displacement of certain bones ; the vertebræ, the ribs, scapulæ, and clavicles, which lose their natural relative position to one another, at the same time that the ligaments on one side become shortened ; these bones then have to be replaced, and the resistance of the ligaments has to be overcome. Finally, there is irregular muscular development of the two sides of the body, existing both as a cause and as an effect. These points then have to be considered ; and the plan of treatment which will most effectually gain the desired end, is the one to be pursued. My own conviction is, that they must, in most cases, all three be combined ; that no one of them will be effectual if employed alone ; that is to say, it is no use supporting the spine without the displaced bones are mechanically acted on with the intention of replacing them, at the same time that means are taken to overcome the resistance of the ligaments ; and that it is no use doing either of these, without the action of the muscles be attended to afterwards, by endeavouring to give increased power where it is deficient. On the other hand, it is of little use attending to the muscular system only, which is done in many plans of treatment ; for it by itself is not sufficient to redress the deformity, but in many cases, as stated before, will only tend to increase it, if the spine be

not first of all brought out of its curved position ; a point which can be easily understood if the origin and the insertion of the muscles are considered, and the action they will have upon the ribs and spine, when these bones are thrown so much out of their relative position.* I shall first explain the means by which the spine can be well and efficiently supported : afterwards, the means to be adopted by which the resistance of the ligaments can be most effectually overcome, at the same time that the bones are pressed in a direction the opposite to that in which they are displaced : finally, the advantages that are to be gained by the exercise of the muscles, and the position best adapted to increase their development, as well as to act upon the spine itself.

The object of all mechanical means or spinal sup-

* Mr. Tamplin says in his lectures, and with which I quite agree, “I most decidedly object to the exercise of the muscles on both sides of the spinal column during the time the curve is in existence, as is most commonly done in a variety of amusing and not less expensive ways to the patient ; as by so doing a direct obstacle is maintained and kept in active operation to prevent the removal of the curvature ; a practice so opposed to common sense, that one is at a loss to assign a reason for it ; and a practice entirely opposed to the course adopted, and found to be of such essential importance, in the treatment of other deformities without exception.” (*On the Nature and Treatment of Deformities.*)

ports, is, or ought to be, to raise the weak and depressed side of the thorax, and to keep up gradual and continued pressure on the projecting or displaced parts; to combine mechanical pressure with mechanical support. The principle of their construction ought to combine strength, and efficiency of action, with simplicity and lightness, to avoid making the apparatus unnecessarily cumbersome and heavy. The means which gain all these points are the best, and consequently those that ought to be employed.

The first point to look to, is to make a foundation which shall be strong enough for the rest of the apparatus to be attached, at the same time that it can be so applied and to such a part of the trunk as to be immovable. The most convenient shape for this part of the apparatus, is a broad hoop, and the most convenient part for its application, is the pelvis, making it grasp the broad portion midway between the crest of the ilium and the trochanter of the femur. It should be so shaped as to fit the pelvis *accurately*, to press equally and to lie in close contact at all points; it should be evenly padded, to guard against irritation of the skin or unequal pressure on the parts beneath. The importance of attending to these points must be evident, when it is considered, that upon this foundation the super-

structure of the rest of the apparatus has to be built ; if it be not then strongly made, and firmly fixed, all action on the spine above will be of no avail.

Having gained thus much then, the other two principles have to be carried out, namely, to support the side of the trunk which is depressed, which in the simple lateral curvature, as already stated, is the left, (the right being the exception,) and to make gradual and continued pressure on the projecting part of the ribs, and through them on the vertebral column ; the pressure being so applied, that it may tell in a direction the opposite to that in which the curve exists. The former principle, viz., that of supporting the depressed side of the trunk, is carried out by adapting a crutch to the most convenient part of the *foundation pelvic hoop*, to support the depressed or sunken shoulder, and so to remove the weight of the upper extremity, by being enabled gradually to elevate it ; by this means the compressed ribs are relieved, and one of the causes tending greatly to increase the curvature of the spine is effectually removed. To carry out the latter principle, namely, that of redressing the curve of the spine, pressure must be applied by means of a broad plate, evenly padded and shaped so as to grasp the projecting ribs and scapula, late-

rally as well as posteriorly, and so attached, that it will admit of being mechanically moved in the direction that will tend mostly to overcome the existing convexity ; for, as already stated, the nature of the deformity is to produce increased convexity of the right side, and a corresponding concavity of the left. The kind of force requisite, and the direction of its application, are well illustrated in the following manner. Stand behind a patient with simple lateral curvature to the right side, place the left hand beneath the axilla of the left shoulder, and press the palm of the right hand against the projecting ribs of the right side of the chest ; raise the two hands forcibly upwards at the same time, and in the large majority of slight cases it will be found that the deformity can be temporarily overcome, and the patient will at the same time express the great relief she will feel while this pressure is being so continued. In fact, this should always be done when examining patients with lateral curvature ; for it will indicate the degree of yielding that may exist in the spine, and will be a guide as to the extent of force which will be required in the mechanical means to be employed ; it will also assist in the prognoscis, both with regard to the degree of relief there can be given, as well as to the probable duration of time the treatment may have to

be continued,—points, however, to be decided upon with great caution, for I should say from my own experience, the amount of relief and the duration of time required can never be fixed with certainty ; causes oftentimes unforeseen arise to delay the cure of comparatively simple cases, while improvement often takes place in severe cases, more than could be expected from the original condition of the spine, when the treatment was first commenced.

Having said thus much with regard to the principle on which the spinal apparatus has to be constructed, I shall describe in detail the mechanism and mode of action of the one I have now employed in many cases, and which I believe gains the essential points above referred to, reserving the description of the obstacles which may exist in the cure of the most severe cases, as well as the combination of other means as adjuncts to the treatment for after consideration ; I shall not, as I have already said, enter into a critical examination of the inventions or of the method of treatment of others, not denying that advantages are gained and cures effected by them ; they are already before the profession in the various works that have been written upon the subject, and can be referred to. My object is to give my own experience of the plan I have adopted, and in which my attempt has been to

simplify as much as possible the treatment, by combining mechanical power with facility of application and little complication, not however professing that all cases can be cured, though many may be, and in by far the majority much relief can be afforded.

The spinal apparatus or support I am about to describe, I wish to state is not founded on an original principle of my own, but upon one which is carried out to a certain extent in most of the so-called spinal supports which have been invented, but more particularly in an instrument employed by my colleague, Mr. Tamplin, at the Royal Orthopædic Hospital. The principle on which his instrument is constructed, and the mode in which it acts, appear to me to be the best that have hitherto been employed, in the adaptation of mechanical means for the cure of lateral curvature of the spine. The instrument I am about to recommend is a modification of the one he employs, and differing in many respects from it ; my object being to gain increased power by using a long lever instead of a short one, at the same time that its construction is simple and admits of being closely adapted to the figure. The force, also, which it exerts upon the trunk, works from one point or centre only of the apparatus, and so avoids all tilting or after displacement. So

little does it project from the body when applied, that the figure, with but a slight modification of the dress, appears but little altered; a desideratum not to be advocated at the expense of usefulness, but one, if combined with it, to be worthy of consideration; more particularly, when the length of time the apparatus has to be worn is remembered, and when the class of patients who most frequently require the use of it, are females, and the majority of them in the better and higher classes of society.*

The foundation of the apparatus consists, as it must in all cases, (where the object is to support one shoulder and to press upon the spine of the opposite side,) of the *pelvic hoop*; it should be made of steel, of sufficient thickness to give it strength for the attachment of the rest of the apparatus, and yet retain its elasticity to admit of being fitted closely to the shape of the pelvis; its

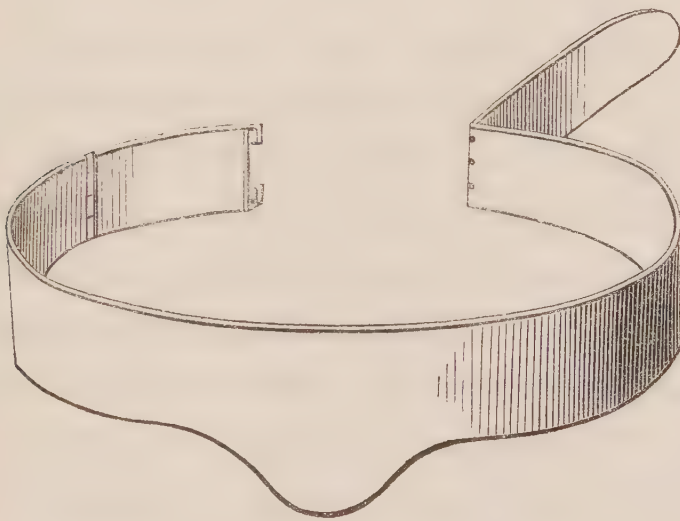
* Most of the spinal supports sold by mechanists and to be found in the shops, are made to act principally by straps and elastic springs; they may be effectual in slight cases, but none of them are capable of exercising the same extent of mechanical power or of acting upon the principle of *pushing* (if I may use the term) the spine in the opposite direction. Mr. Tamplin's instrument is in fact the only one that I know to be capable of applying this kind of force. For a description of it, I must refer to his excellent lectures on the "Nature and Treatment of Deformities."

depth must depend on the size of the patient ; in children being about two inches, and in adults from two inches and a half to three inches. In shaping the hoop, the points that have to be considered are, to make the posterior two-thirds form the portion of a circle which the pelvis has in the living body, from points below the anterior spinous process of the ilium of one side, backwards round to the opposite side, the muscles and fat filling up the hollow that exists in the skeleton. The anterior part of the hoop must form a smaller segment of a larger circle, for in this situation it has to press upon the lower part of the abdomen, which is flatter than the pelvis. These points are necessary to be considered to make the hoop fit accurately.

The anterior part of the hoop should be made to open in front by means of a hinge on either side, to allow of its application : it is fastened by one end sliding into the other, and fixed by one broad or two narrow straps, strongly sewn to the leather covering with which the hoop is surrounded. By this contrivance, the hoop can be opened to a wider extent than the simple elasticity of the metal would allow consistently with strength ; these hinges do not weaken the hoop when fastened, and in well-formed females with the pelvis large, for whom the hoop requires to be proportionably

strong, a contrivance of this kind will be found to be necessary.

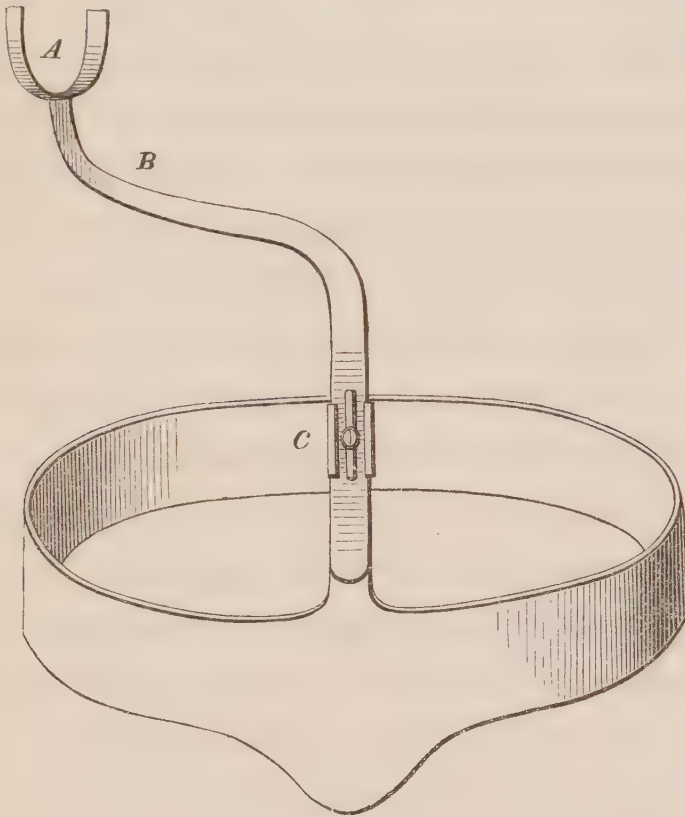
The posterior part of the hoop should be made to dip down, shaped something like the sacrum, on which part of the body this portion has to rest; it thus prevents the instrument tilting, and fixes it more firmly to the pelvis. The two portions in front should be long enough to fit well into each other, for full two inches or more, to leave room for the hoop being loosened or tightened as may be required; the whole inner surface is to be evenly padded, but not thicker than is necessary to guard against friction and pressure on the soft parts with which it lies in contact.



Having gained then this foundation hoop, which I have been particular in describing, since without

it fit properly, the rest of the apparatus will be useless ; the next point to consider is, to raise the depressed shoulder, which, as before stated, is the left. This is to be done by means of a small crutch, placed beneath the left axilla, presuming the common form of lateral curvature to be under treatment, when the left shoulder is the one that drops ; and under the right axilla, if the curvature be to the opposite side. This crutch is to be attached to an arm made of steel, passing obliquely from its under surface round to the posterior part of the ribs, reaching as far as the centre of the spine, or to that point which the spine ought to occupy in the normal state ; from this point it is made to pass vertically downwards, and is to be firmly fixed to the centre of the posterior part of the pelvic hoop, as near to its upper edge, consistently with strength ; it will then be less likely to tilt the hoop in front. These two parts of the apparatus, namely, the pelvic hoop and the shape and mode of attachment of the crutch, are shewn in the following wood-cut.

There are one or two other important points to consider in this part of the instrument, to ensure its object. The crutch part A must be made of a size to fit the axilla easily, to grasp the anterior part of the shoulder evenly, and not to press at the front more than at the rest of the fork ; this is effected by



making the sides of the fork of the crutch to rise vertically instead of to form a semicircle, while the middle of it is nearly, if not quite, horizontal; equal and more general support is thereby given to the shoulder, with less liability of it slipping off. The fork of the crutch should not be made higher than necessary, to avoid an unsightly projection beneath the dress, at the same time that no advantage is gained by so doing.

The oblique arm B is so shaped, that its upper or axillary portion, as it may be called, passes

downwards first of all in a vertical direction, to support the crutch more firmly ; it should not do so, however, for more than an inch, to avoid lateral pressure. It is then to be continued backwards and downwards obliquely, and curved so as to stand out from the ribs, to leave a free space beneath it ; for the obvious reason of avoiding all pressure on the left side of the thorax, (which, as already stated, is the contracted side,) and to admit of the expansion of the ribs, which could not take place were pressure made against them. The curve and length of this part must be sufficient to support the shoulder with ease, and to make slight traction backwards at the same time ; a force that is wanted and which will act beneficially, by tending to relieve the left side of the thorax of the superincumbent weight of the upper extremity.

The remaining points to be considered, with regard to this part of the apparatus, are, the fixing the vertical bar which connects the crutch, and the means of raising it at pleasure, which will be required, as the cure advances. I believe the best situation for doing this, as already stated, is, to the centre of the posterior part of the pelvic hoop, for the pressure then tells on a point which guards against all lateral tilting of the instrument ; at the same time that it leaves the whole of the left side

open and uncompressed, it moreover leaves the waist free, and allows the dress to fit more closely. In all the instruments I have hitherto seen, the crutch is connected by means of a vertical bar, that passes directly down to the same side of the pelvic hoop ; it is then difficult to prevent it pressing against the ribs, and so must oppose their expansion, without it be made to stand out to some extent, which makes the apparatus more unsightly and inconvenient to the patient, necessarily causing the size of the waist to be increased, and the shape of the figure to appear more awkward when the dress is fastened over it.

The other point, namely, that of raising the crutch, is to be gained by means of a slide, fixed by a screw. In the apparatus I am now describing, this is effected by attaching the slide to the centre of the vertical bar ; by elongating this part, the crutch can be raised at pleasure. The slide is represented at C, in the last wood-cut, p. 65. This slide might be placed immediately below the fork of the crutch, in the axilla ; the objection to this would be, that it would require a lateral portion to pass downwards and to be placed against the ribs, which would then be liable to press upon them, an evil already stated, to be avoided ; one great object being to leave the left side of the thorax free and unconfined.

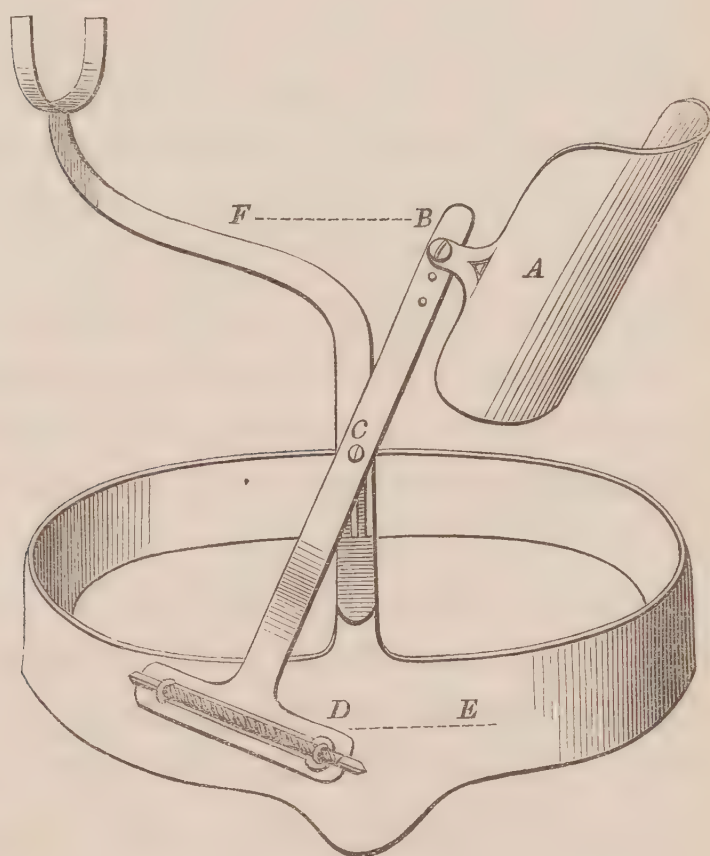
The next point to be gained, is, to act upon the curvature of the spine itself; to keep up pressure upon the expanded and projecting ribs, which produce the convexity on the right side of the thorax, and which throw the scapula and shoulder upwards. This is to be effected by acting mechanically upon the ribs, and through them upon the spine; for there are no other means of getting at the spinal column in the lateral curvature, except by making pressure directly against the ribs; and this, I believe, may be most effectually done in the following manner.

A broad plate must be shaped to fit the most convex part of the thorax, and made to extend round to the side of the ribs, so as to grasp them beneath the axilla; the extent to which it passes upwards or downwards depending on the size of the projection, the centre of the plate being opposite to the most prominent part of the convexity. The plate should accurately fit the shape, that it may lie in close contact with the whole of the projecting portion of the thorax, against which it has to be applied and which it has to support.

Having constructed this plate, then, the means have to be considered by which it will most effectually press against the ribs, with the intention of acting upon the spine, and of throwing it over to the opposite or left side, from which it has receded.

To do this, great mechanical force is required, as well as the power of gradually increasing it. This power, I believe, is best obtained by means of the lever, and it is best regulated by employing a screw to move it, in the following manner. A steel bar, strong enough to resist bending and as light as may be consistent with strength, is made to extend downwards from the inner or posterior edge of the plate, and long enough to reach to the centre of the pelvic hoop behind. The object of this bar being to act as a lever, it must have a fulcrum to move upon; this is gained by attaching it to the centre of the vertical bar of the crutch by means of a screw, which forms a centre or axis upon which it may move. To the upper end of the lever, the plate which grasps the ribs is attached, by means of a screw perforating a small arm of an inch or more in length, extending laterally from the plate. To the lower end of the lever, then, we have to look for the moving power, and this is to be gained by so shaping it, that a slide is made at right angles with it, crossed by a small button which keeps it braced down to the pelvic hoop. It is worked by a long screw, attached to one end of the slide passing through the button just mentioned. This screw is turned at pleasure by means of a key, drawing the lower end of the lever to the right side, and conse-

quently throwing its upper end, and with it the plate which presses against the projecting side of the thorax, towards the left ; the kind of force which is required to act upon the spine. This part of the apparatus it is difficult to describe, and will be rendered more intelligible by referring to the wood-cut.



A, is the plate to grasp the convex side of the thorax.

B, is the upper end of the lever bar, attached by

a screw to the plate, through a small arm projecting from its inner edge, allowing of motion to accommodate the plate more directly to the side of the chest.

C, is the screw, which forms the centre of motion, and which attaches the lever to the vertical portion of the crutch.

D, is the groove at the lower end of the lever, forming a small segment of a circle, placed at right angles, and which, when moved by the screw, draws the lower end of the lever in the line DE, and consequently moves the upper end, and the plate A which is attached to it, in the opposite direction, namely, in the line BF.

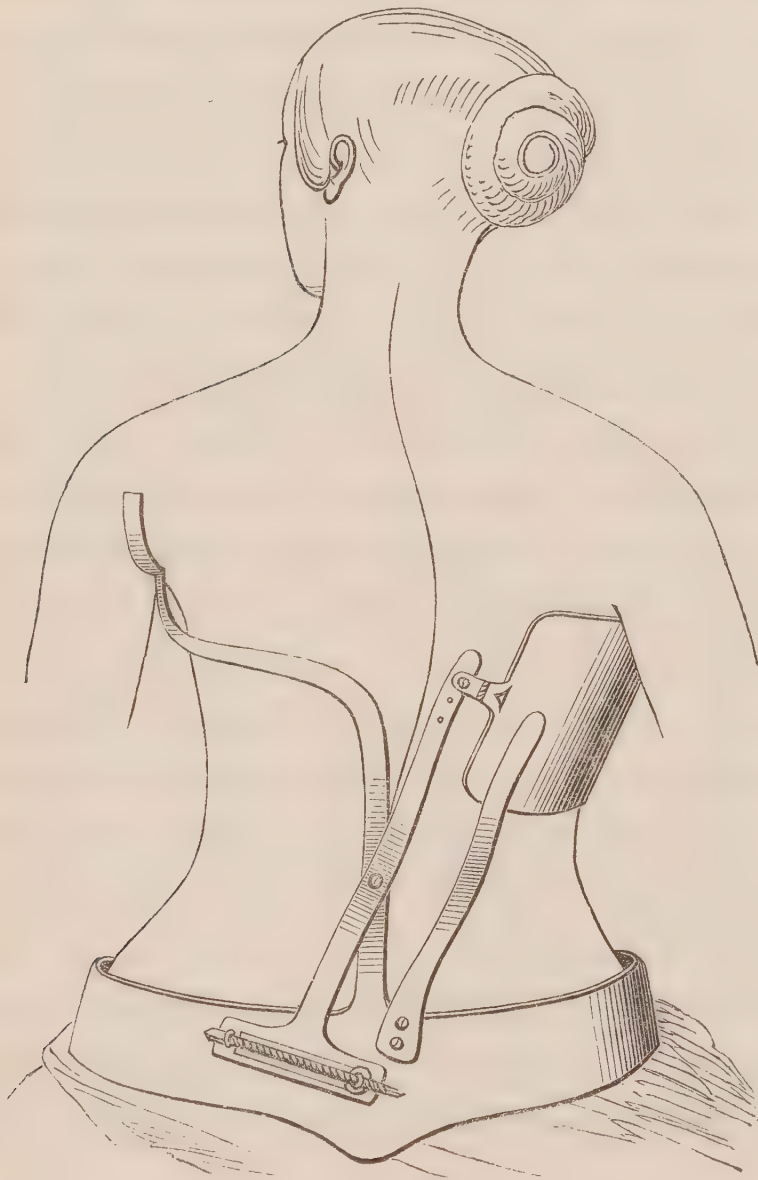
By this instrument, then, the important points to be attended to, in order to redress the lateral curvature of the spine, are gained. The sunken shoulder is raised, the depressed ribs are left free and relieved from the superincumbent weight of the shoulder and upper extremity, support is given and pressure applied to the convex side of the ribs, and through them to the spine itself, by the great power which can be applied by the use of the long lever attached to the plate which grasps the thorax, which power is graduated and capable of being increased by the screw, regulated at pleasure by means of a key; the whole being attached to a firm base, namely, the pelvic hoop, which is ren-

dered immovable by being made to fit accurately and firmly to grasp the shape of the pelvis. All tilting is avoided by making the moving power act from one point, viz., the centre of the instrument behind; to which the other parts of the apparatus are also attached.

The only other point to attend to, is to bend the vertical portion of the apparatus sufficiently forwards to make it lie closely against the spine, which is done by curving it at its junction with the pelvic hoop, so that it may fit well into the hollow of the back.

The application of the instrument is easily understood. The pelvic hoop is to be opened in front, and to be placed round the pelvis, so as to grasp it just above the trochanters of the thigh bones, resting in fact upon the broad alæ of the pelvis. The crutch is then to be placed under the left arm, and the plate against the projecting ribs on the opposite side of the thorax. The hoop is then to be fastened in front, by sliding the one portion into the other and fixing it with the straps and buckles. The crutch should be raised to a height sufficient to support the shoulder easily, avoiding undue pressure on the vessels and nerves in the axilla, and also irritation of the skin. The crutch is to be raised by degrees, as the cure advances, by means of the slide C in the wood-cut,

p. 65. The lateral plate is then to be acted upon by the screw attached to the lower part of the lever bar, until sufficient pressure be made to tell against the side of the thorax, to be increased gradually as the spine yields in the opposite direction; the wood-cut shows the instrument when applied.



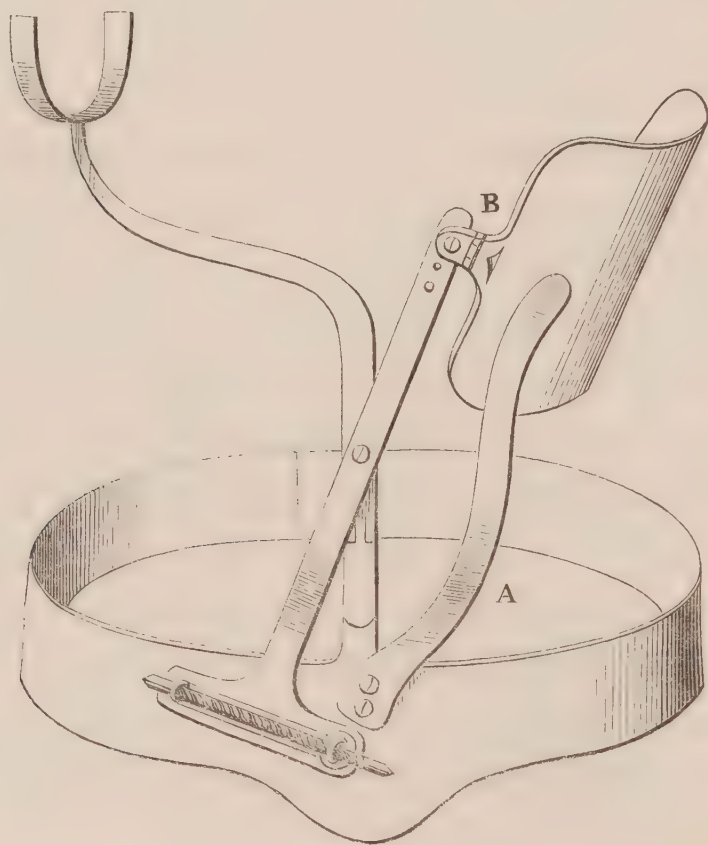
To recapitulate the advantages gained by the above instrument ; First,—the fallen shoulder is supported, and so one of the causes tending to keep up and to increase the deformity is removed. Second,—the whole of the left side of the thorax remains free and uncompressed, and ample room allowed for the expansion of the ribs. Third,—the convex or projecting side of the thorax is pressed against, and through it, the spine is thrown to the opposite side by aid of the two great mechanical powers, viz., the lever and screw. Fourth,—the whole of the support and the moving power act from the same part of the apparatus, namely, the centre of the pelvic hoop behind, so that all tilting or lateral motion is guarded against. Finally,—the whole apparatus lies closely in contact with the body, the waist is left free and unconfined, and the shape of the figure and dress so little interfered with as to be but slightly altered,—trivial points, as before stated, in comparison with usefulness, but important when capable of being combined with it, when the length of time the apparatus has to be worn is considered, as well as the class of people who generally require its use.

Of the power of redressing slight lateral curvatures of the spine, possessed by this instrument, there can be no doubt, from the experience I have

already had in its employment ; for the great force which can be exerted by the long lever cannot fail to act upon the ribs, and through them, upon the vertebral column itself ; in fact, its power is so great, that it requires to be very cautiously regulated to avoid painful pressure, and this point is ensured by the screw, which can be turned at pleasure. In severer cases, the advantages gained are quite as great, though necessarily less apparent, from the deformity itself as well as the resistance being so much increased, at the same time that the force can only act by slow degrees. In these cases the improvement must necessarily be slow ; it cannot be otherwise when the nature of the deformity is considered.

In the cases where the ribs form an angular projection backwards, which in the severer kinds of the deformity is often met with, there is more difficulty in making the plate fit accurately to the posterior part of the projection, so as to press it in a line forwards as well as laterally, which is now required. Attention must be paid in making the instrument, to curve the vertical bar forwards, to which the crutch is attached, and on which the lever moves, that it may lie in the hollow of the spine. This point I also gain, by fixing a strong flat spring to the centre of the upper edge of the pelvic hoop

behind, and making it pass obliquely upwards, and to lie on the plate without being attached to it, that it may not interfere with its lateral motion, at the same time that it presses it directly against the angle of the ribs, so throwing this part of the thorax forwards and tending to diminish the projection. The plate is made to adapt itself more closely to the ribs, and is more effectually acted upon by the spring, by having a small vertical hinge at its point of junction with the upper end of the lever bar. The wood-cut represents the instrument, with the addition of the strong spring A just re-



ferred to, and the small hinge B, which allows the plate to be pressed forwards.

So far, I have been describing the instrument and its application to the single curve to the right side only ; but there are many cases where the second curve exists, occupying the lumbar region, and causing a projection to the left side of the spine, with the apparent prominence of the right hip. These cases require no special apparatus with the intention of pressing against this lumbar curve, for no good can be gained by so doing, as its existence is dependant on the upper or dorsal one, and its removal can only take place, and in the majority of cases will do so, as soon as the latter is partially or entirely redressed. The principle to act upon, then, is to apply the mechanical means in such a manner, that the weight of the head and shoulders will be taken off the spine, and that the dorsal curve and projecting ribs will be supported as much as possible. Remove the dorsal curve, and the lumbar will gradually diminish.

Having fully described the construction of the apparatus, its principle of action, and its mode of application, and believing that by its use the majority of cases of lateral curvature can be relieved, and many of them cured ; if asked, whether I think it gains all that can be desired ? I answer, no : but

that by combining other means with it, as accessories to the treatment, its efficiency may be greatly increased, and its action rendered more available. The means I refer to, are, the employment of the recumbent position in a manner I shall now point out, and the exercise of the muscles at a proper period of the treatment. I shall consider the former of these means first, being satisfied that both of them may be employed as useful adjuncts to the apparatus I have been describing ; a combination however of the three possessing advantages, which cannot be obtained by the employment of any one of them by itself.

OF THE METHOD OF EMPLOYING
THE
RECUMBENT POSITION,
AS AN ADJUNCT ONLY, IN THE TREATMENT OF
LATERAL CURVATURE.

THE usual position recommended by most authors who have written on lateral curvature of the spine, is, to place the patient on the back, and then by means of pulleys and weights, acting upon the lower and upper extremities to draw them in opposite directions; the object being, to stretch the spine and to pull it from the curved into the straight line. At the same time that the spine is being stretched, the muscles of the upper extremities are also exercised by various contrivances, attached either to the couch itself, or to some part of the room. My own opinion is, that this position is not the best one that can be employed, believing that it acts mechanically with the least advantage upon the spine, for reasons I shall presently give when advocating the position I have to

recommend instead of it. I am opposed to the exercise of the muscles before the curvature has been either completely cured, or as much relieved as the nature of the case will admit of, for the reasons already adduced when speaking of the causes of lateral curvature, namely, that the muscles themselves after the curvature is once produced, tend by their action to increase it; and I more particularly refer to the spinal muscles, both those which are proper to the spine itself, and those which are connected with the ribs; they both draw the concave side of the spine more and more downwards, the more powerful the action they exert. For this reason, then, I should avoid increasing their power so long as any curvature may exist and the spine itself be yielding, and therefore should not combine it with the stretching position, did I think that one the best adapted to mechanically overcome the deformity. This view appears to me to be rational, and I am not aware it has been before advanced, except by Mr. Tamplin, to whose lectures I have before referred. I shall consider it further, when speaking particularly as to the amount of advantage that may be derived from the use of muscular exercise, and of the manner in which it ought to be employed.

The length of time required by the practice of

placing the patient constantly on the back, occupying months and even years; though it may act by stretching the spine and by bringing it from the curved to the straight line, it must, I conceive, in the majority of cases be injurious to the health, producing general debility of the whole frame, being tedious and irksome, and must often interfere with many of the functions of the body; besides which, it cannot be constantly preserved, there must necessarily be many occasions when the patient will have to alter her position from the horizontal to the erect one, when the spine will naturally fall towards the original curved condition, and will lose in a very few minutes the advantages it may have taken hours to gain. Independently of which, the strongest reason of all I have to advance against it, is, that I believe it to be totally unnecessary; that it is so much time lost; and that quite as much if not more good can be gained, without putting the patient upon so tedious, irksome, and confined a plan of treatment. Of this, I am convinced from my own experience in treating cases without having recourse to its employment.

Another plan of treatment advocated by some, and one that is very generally adopted at an institution* solely for the treatment of spinal curvatures,

* The Verral Charitable Society.

is, that of placing the patient in the prone position, making the girl lie on the chest and abdomen on a couch fitted for the purpose,* combining with it at the same time, muscular exercise of the upper extremities, while the lower are made to hang downwards by their weight, and to pull upon the spine in that direction. I object to this position for the treatment of lateral curvature, for the same reasons, namely, that it acts upon the spine with the least mechanical power, while the length of time that is required to gain any advantage is necessarily great, and might be employed in a more beneficial manner.

If position is to be recommended at all as a means to overcome the curvature, and as such I am convinced it may be, surely that one ought to be employed, which acts upon the principle that most favours any mechanical power that it can exert to redress the deformity. A simple illustration will exemplify the principle I wish to advocate. If we desired to straighten a bent stick or rod of iron, should we stretch it by pulling upon the two ends in its long axis? should we not rather attempt

* This position is admirably adapted for angular curvature of the spine, depending on disease of the vertebræ. It was first introduced by Dr. Verral, and has been practised by him and by others, with great success.

to *unbend* it, by placing the most curved part on some body to form a fulcrum, and then act upon the two extremities by applying a lever force in a direction opposed to the curve? would not a bent stick be most easily straightened by placing the curved central portion on the knee, and then drawing or pulling on its two ends? The same may be done with the spine, at least it appeared to me that such might be effected when I first began to pay attention to the subject, and I have been fully borne out by the practice I have adopted. I thought that the weight of the body, which is one of the principal causes, if not of producing the curvature, at any rate of afterwards increasing it, might be made, by applying the power it can exert, to act with a force sufficient to bend the spine in the opposite direction. The position which gains this point, and which allows the weight of the body to act in this manner, I have now to explain; it is simple, and at the same time is most effectual.*

* Since writing the above I have seen Mons. Guerin's work, "*Sur les malformations du système osseux.*" He advocates the same principle, though he carries it out by the employment of a different position. He places his patient on the back and flexes the spine in opposite directions by means of powerful screws, moving different portions of the couch, to which the whole body is fixed in the horizontal position, by straps and other complicated apparatus.

I recommend that the patient should be placed on the side, on which the projection formed by the curve exists, instead of on the back, and allow the legs, the head, and upper extremities, to fall to a lower level than the trunk ; by this means a sufficient power is at once gained, by the simple weight that is then exerted at either end of the trunk, to gradually act upon the spine and to regulate itself ; imitating, in fact, the straightening of a bent rod or stick : no other mechanical means are required ; the weight of the legs at the one extremity, and of the head and shoulders at the other, exert a force quite sufficient to redress any slight curvature that may exist, and as much as can be borne, or it may be judicious to apply in severer cases. The object is to stretch the ligaments, and so to overcome their resistance, at the same time that the bones themselves are pressed in a direction the opposite to that in which they have been displaced, and are thus rendered more moveable and more capable of being acted upon, by any apparatus that may be afterwards employed to give them support,—points to be more particularly referred to, and which I shall explain after describing the means by which this position is to be obtained.*

* Mr. Alexander Shaw informs me, that he is in the habit of placing a firm pillow or cushion beneath the projecting side

I employ a couch of the following construction ; it is 6 feet in length and 2 feet in width ; the horizontal portion on which the patient lies, consists of a framework divided into three parts ; the central portion, which is the smallest, is fixed and connected to the sides of the couch, more towards the upper than lower end, to be opposite to the thorax when the patient is placed upon it. To this central portion there are two others attached by hinges, moving up and down like the flaps of a table, and which admit of being fixed at any angle by means of sliding quadrants, that pass through two bars, extending from the under part of the central portion of the couch, down to two spindles that connect the legs together.

The ends of the couch itself are disconnected at the upper and lower part, so as not to interfere with the motion of the flaps. By this means, the level of the legs, or of the head and shoulders, can be altered at pleasure, by letting either the upper or lower flap of the framework or both fall as much as may be required, and fixing them by a common thumb-screw working against the sliding quadrant underneath.

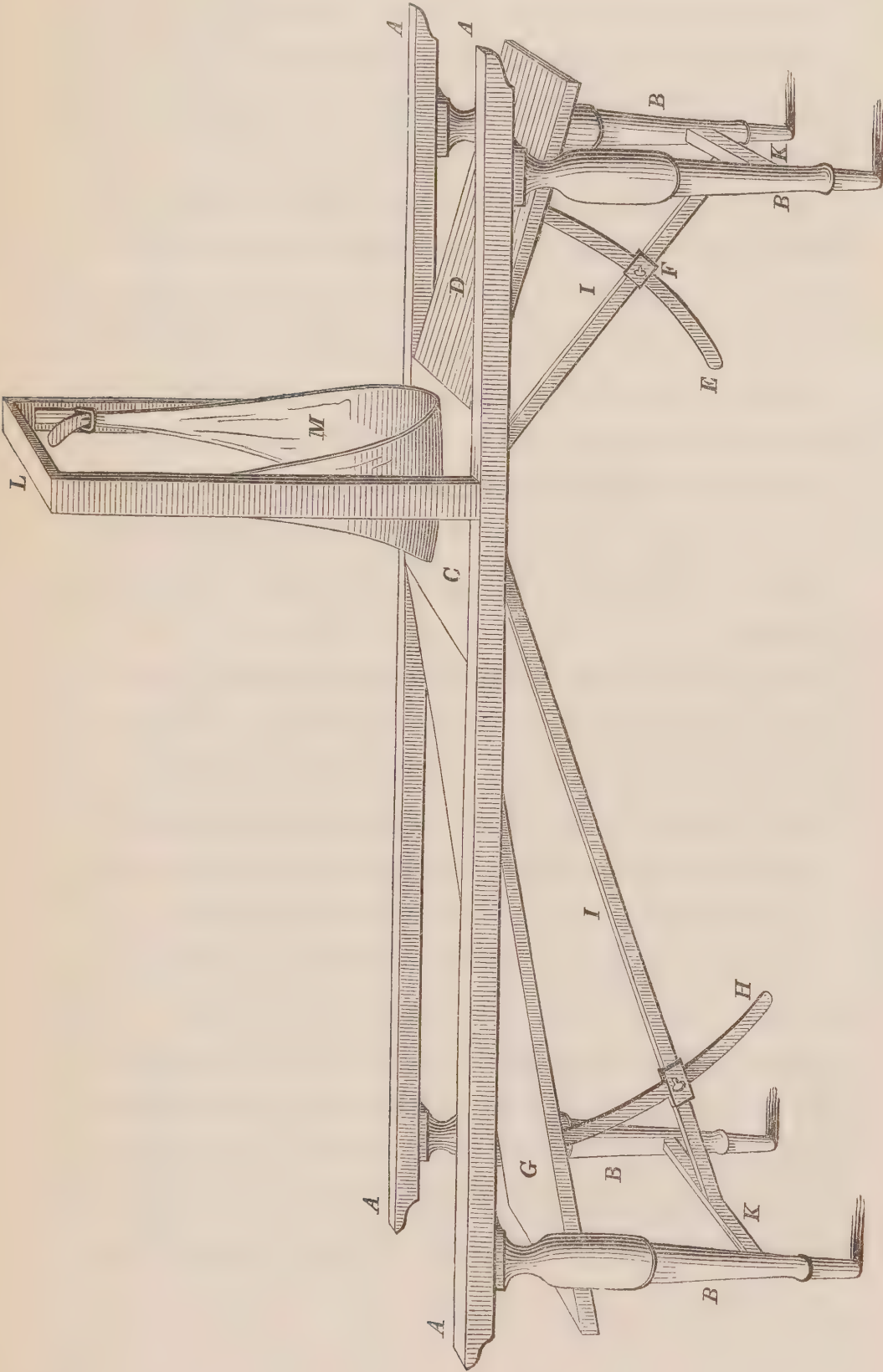
of the thorax, at the same time that he employs extension and exercises the muscles. This cannot however act upon the spine in the effectual manner I am now recommending.

When the patient is placed upon the couch, the body is supported by a sling made of a broad belt, 6 or 8 inches wide, attached by a strong strap and buckle on either side to a perpendicular framework or yoke thrown across the couch, and fitting into it, nearer to the upper than the lower end, that it may be opposite to the thorax when the patient is placed within it. This belt admits of being raised or lowered, and can be made to act upon the curve of the spine, by the straps or buckles with which it is attached to the perpendicular framework just described. The two following wood-cuts shew the construction of the couch and its application; the first illustrates the couch itself; the second, the position of the patient when placed upon it; a reference to which will facilitate the above description, and will explain the principle on which it acts.

AAAA, the two lateral portions of the couch, open at either end and supported by the four legs BBBB.

C, the central horizontal portion, fixed to the sides AAAA, more towards the upper than lower end, to be opposite to the thorax.

D, the short flap for the head and shoulders to rest upon, attached by hinges to the central portion C, being raised or lowered by the quadrant E, and fixed by the thumb-screw F.



Couch for producing Lateral Flexion of the Spine.

G, the lower flap, on which the legs rest, also attached by hinges to C, admitting, like D, of being raised or lowered by the quadrant H, and fixed by a thumb-screw.

II, the long bars, through which the quadrants slide, fixed at their upper ends to the under part of C, and at their lower ends to the spindles KK.

L the perpendicular framework or yoke fitting into the edges of the couch AAAA, made to take out, for convenience in moving the couch.

M, the broad belt, attached by straps and buckles to the inside of the upper part of the perpendicular frame L, admitting of being raised or lowered at pleasure.

The remaining part required to complete the couch, is a firm even mattress, made of flock or horse-hair, long enough to extend its whole length, and not wider than the flaps or moveable portions, to allow of it passing with them between the sides of the couch AAAA, when they are lowered.

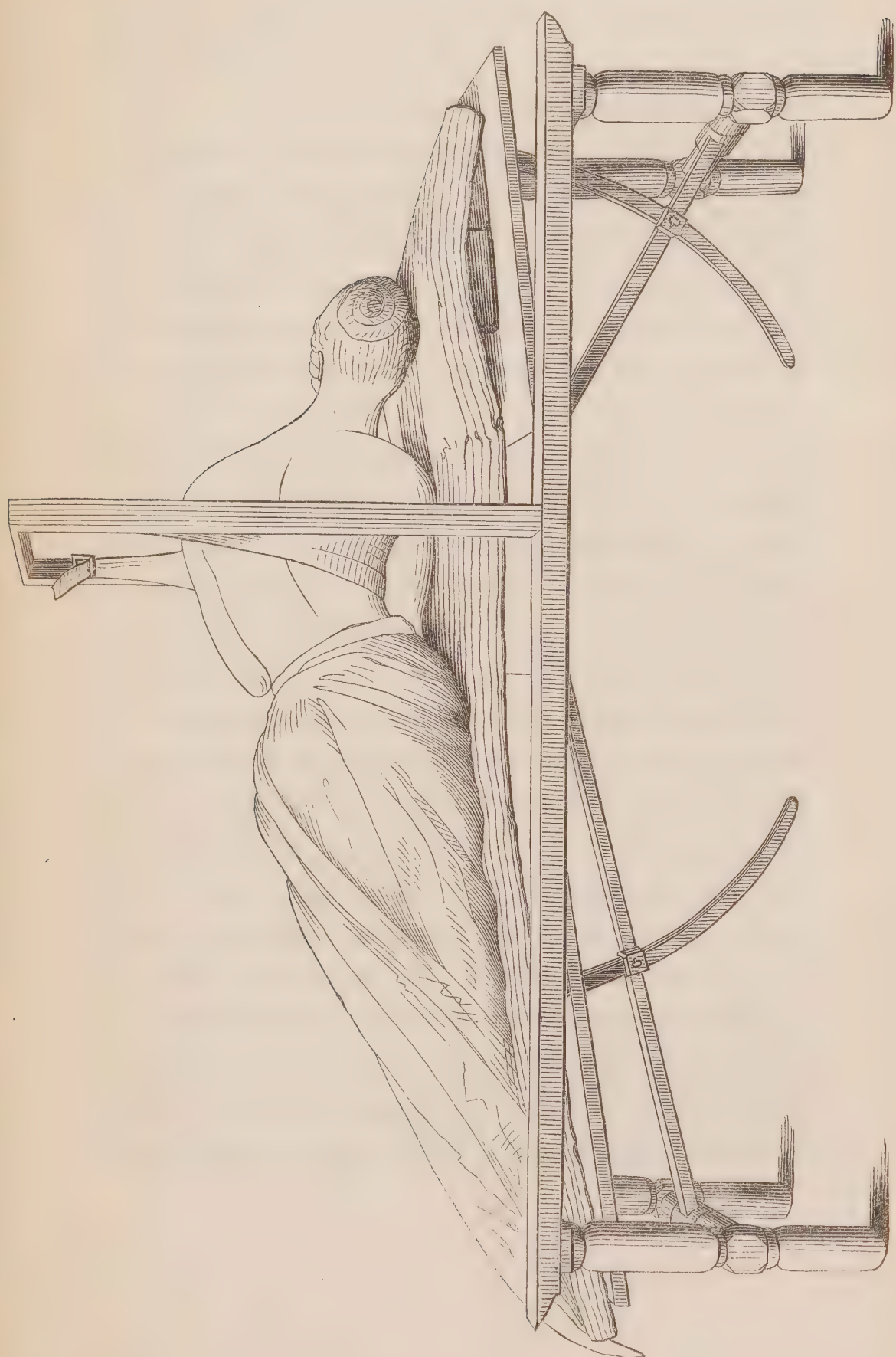
I shall next explain the method of using the couch, which may be easily understood. The patient is to be placed in the belt M, being made to lie on her right side, which is the projecting one, caused by the curvature of the spine forming the arch in that direction. The belt should be so placed, that the pressure may tell on the most convex

portion of the thorax, the body being slightly turned on the back, so as to support the angle of the ribs more than the centre, (when the ribs project at this point,) and to support the scapula as well. The patient should remove her stays and wear a loose dressing-gown to avoid any hard or irregular folds pressing against the skin, as well as to leave room for the expansion of the compressed ribs, which are now, in the position the patient is lying, placed uppermost. The flap G of the couch, on which the legs rest, is lowered to a sufficient extent to make a slight strain upon the spine, and the upper flap D is lowered in a similar manner, but not to so great an extent, for it cannot be borne, owing to the difference in the length of the neck compared with the legs, as well as to avoid causing head-ache. The patient's own feelings must be consulted as to the extent to which the couch is to be lowered. The belt is required to be raised only to an extent sufficient to swing the body, and to prevent the thorax from pressing against the couch itself. The reason for raising the thorax and for not letting it lie on the central portion of the couch without the belt, is, that the pressure of the belt is more elastic, and therefore can be borne with greater ease, at the same time that it fits more closely to the shape of the ribs, and tells upon

a larger surface and therefore with greater effect. The next wood-cut shews the position of the patient on the couch lying on the right side, the dress being removed from the back, to shew the alteration in the curve produced by the spine being thrown towards the left side; the weight of the head and shoulders at the one end, and of the lower extremities at the other, bending it in a direction the opposite to the one it takes when the body is in the erect position.

The great power possessed by the above simple position, of *unbending* the curve, can be easily ascertained by passing the finger along the spine after the patient has been placed in the belt; at the same time the compressed ribs will be found to be expanded; the degree in which the spine and the ribs may yield, of course depending on the severity and extent of the deformity. In slight cases it redresses the curvature at once, and in severer ones it produces an alteration quite sufficient to shew its power of acting.

It may be asked, is it intended to keep the patient in this position till the curvature be cured? If so, it will be more irksome than the horizontal or prone position, and in fact cannot be borne: nothing then is gained over the ordinary position, nor so much as by placing the patient on the back.



My answer is, this is not the intention, nor is it the object for which the couch is employed ; and this point I shall next consider.

I recommend the above position of the patient as an *adjunct* only, and a most useful one, I am convinced it is, as forming a part of the treatment of lateral curvature of the spine. The simple object I have in view, is to render the spine more flexible ; to make it more yielding in the opposite direction to that in which it is curved ; to overcome the resistance of the ligaments by gradually stretching them ; to render the bones themselves more moveable, by pressing against them in the direction the opposite to that in which they have been displaced, —both the vertebræ themselves as well as the ribs ; and at the same time to overcome the resistance of the muscles which have hitherto been acting in one direction only,—imitating, in fact, the treatment of the muscles and ligaments in a contracted joint. All these points may be and are gained, by employing the position on the couch that I have been describing, for an hour or two hours daily ; a length of time not at all irksome to the patient, and not at all injurious to the health. It must of course be followed up with perseverance regularly day by day, a point that must be determined on in this as in any other treatment, which may be required for

the cure of any malady that nothing but time can remove.*

The couch I have described possesses other advantages than those I have pointed out, as fitting it particularly for the lateral flexion of the spine. It may be adapted to place the spine in any position that may be required, whether it be the prone, the supine, or the lateral, either for disease or for simple curvature forwards or backwards, for the treatment of which it may be necessary to employ one or other of these positions.

As I have stated, I merely employ the above position as an adjunct to the rest of the treatment, and to gain the objects I have just mentioned I adopt the following plan. After the patient has remained in this position for an hour or an hour and a half (and longer if it can be borne); immediately on her rising from the couch, I adapt the instrument I have already described, to the spine and thorax, *to retain any advantage that may have been gained*, and to support the spine at once after having been thus bent in the opposite direction,

* I do not, as a rule, require the patient to remain for more than an hour, it being quite sufficient if followed up with perseverance every day. There can be no objection, however, to a longer period if the patient can bear it; on the contrary, the resistance will be overcome so much the sooner.

making the instrument act more each day. It may be so gradual, however, as to be scarcely visible ; for although in some slight cases the effect produced is marked and evident in a short period of time, the improvement in severer cases can only be measured by comparing longer periods with one another. I am much mistaken, if they who publish rapid cures of spinal curvature do not select the slighter cases, and not those which are, many of them, if not incurable, at any rate so severe and unyielding as to render it impossible by any means to produce even a partial relief, except by long and persevering attention to their treatment.

In the treatment of lateral curvature of the spine, so far, I have endeavoured to describe the means by which two grand objects may be gained ; viz., the complete relief and removal of the deformity in some cases, and the partial relief in others, the extent to which this relief can be carried depending upon their degree and severity. These means consist in the application of firm mechanical support, and in position ; the former sustaining the spine, and acting mechanically in the most favourable way to remove the weight from the weak side, and to keep up pressure, which admits of being gradually increased, against the displaced or projecting side. The latter, viz., position, overcoming the resistance of-

fered by the shortened ligaments, and pressing the displaced bones in a direction the opposite to that in which the deformity has thrown them ; acting, by allowing the weight of the body so to tell upon the curvature, that the spine can be brought into the opposite direction to that produced by the curve, by gradually *unbending* it, and by tending to replace all those parts which constitute the deformity. Both these points, I believe, can be effectually gained by the spinal support and by the couch I have recommended.

OF THE
EXERCISE OF THE MUSCLES
IN THE TREATMENT OF
LATERAL CURVATURE OF THE SPINE.

THE next point to be considered, is, the exercise of the muscles—an important point also. And here two questions arise; the first, how far the muscles may produce or increase the deformity?—the second, how far they can be made subservient, and to take part in redressing or curing the curvature? I have already stated, in the early part of this treatise, that I think by far the majority, if not all the cases of lateral curvature, are primarily produced by the mechanical weight of the head and upper extremities telling unfavourably on the spine, and throwing it out of its natural perpendicular line, from the body being placed in some position that destroys the equal balance of the two sides. The muscles at this early stage act secondarily, and increase the curve after it has once commenced. This is a point I also entered upon, and stated that I did not think

sufficient, if any, attention had been paid to it by those who had written on the subject. To repeat what I then said ; I believe, that after the curvature has once commenced, the muscles situated on either side of the spine, whose natural action is to balance the vertebral column in the erect position, lose the power of so doing, and only tend to increase the curve, by approximating the upper end to the lower as soon as it is thrown out of the erect line ; and both sets of muscles, namely, those on the convex as well as on the concave side, will have this effect, which is easily explicable when their position is considered, and the shape the spine will take when curved ; they are then similar to a string acting upon a bow.

That the muscles on the convex side of the spine have not the power to redress the curve, is evident ; for what do we find ? Why, that they are always the strongest and the most developed on the right side, and that in spite of this, the deformity still goes on increasing on the left, and, in many cases, after those on the opposite or concave side have become so much wasted as to cease to have any power to act as antagonists. This view of the action of the muscles is of the highest importance, if correct, and such I believe it to be, both for the above reasons as well as for those which I shall give in the

rules to be laid down for the exercise of the muscles as a means of treatment. The conclusion I should come to from this view is the following,—that to exercise the muscles of the back, including those of the upper extremities, without mechanically relieving the spine of its superincumbent weight, does more harm than good, and that it increases the deformity rather than relieves it; and that what is termed general increase of muscular development by indiscriminately employing gymnastic exercises, is not to be recommended. I now more particularly refer to those cases of lateral curvature, where the deformity does not depend on weakness of the muscles as the principal cause, but upon confirmed and mechanical displacement of the bones of the vertebral column and ribs.*

It may be asked, however, cannot any cases be cured by attention to muscular exercise properly employed? Are we not to believe those who

* I have two cases under my care of fine healthy young women, who have never had any illness to weaken the system, and in whom all the muscles are apparently well developed equally on both sides of the spine and in the upper extremities, who are rapidly improving by the position I have recommended and by wearing mechanical support only. In both these cases, I believe, were muscular exercise only had recourse to, the curvature would be increased.

maintain that such can be done, and who bring forward cases to prove it? To both these questions, I answer, yes. But, on the other hand, I would ask, how many cases have they met with where the question might be answered in the negative; where, with all the exercise of the muscles that may have been employed in the various gymnastic games, &c., the deformity has in its main features remained the same? The muscles on the weak side may have been increased in power, but the deformity may not have been relieved. I believe that were an honest statement made by the advocates of this system, numerous would be the cases where their efforts have been of no avail. The fact is, and this it is my object in the present short treatise to endeavour to shew, that the treatment must not be confined to one single principle, but that the three must be combined; the two first of which I have explained, namely, the due and efficient mechanical support of the spine and ribs and of the depressed shoulder, and the stretching the ligaments by unbending the curve in the position of placing the patient on her side.

I shall first of all endeavour to point out those cases where the exercise of the muscles may form the most essential part of the treatment: secondly, those in which, if it be solely employed, it may do

more harm than good : and, thirdly, those in which it is altogether useless.

The cases in which the exercise of the muscles may be employed with beneficial effect, and form a most important part of the treatment, I believe will be found to be the following. Girls of spare habit, in whom the whole muscular system is weak ; where the vertebræ are thinly covered with the muscles, the spinous process being prominent throughout the whole length of the spinal column ; the scapulæ on both sides projecting and wanting their close adaptation to the ribs, owing to the absence of sufficient power in the muscles to keep them in their natural position : where the curvature of the spine is general throughout its whole length, and can be easily altered in one direction or the other, the bones being but loosely connected owing to deficiency of strength in the ligaments ; the shoulder of one side being higher than the other, though not to any marked extent, and the ribs of the left side, though less convex than on the right, still are not compressed to an extent sufficient to cause a hollow beneath the left scapula : lastly, where the curvature has existed for a short time only, and will admit of being easily redressed by pressure made with the hands. Under these circumstances, whatever the age of the girl may be, whether before or after

puberty, much may be done by increasing the development of the muscular system generally, paying particular attention to that of the muscles of the spine and upper extremities ; at the same time that the health of the girl is to be improved by the administration of tonic medicines, strengthening diet, and placing her in a situation to breathe pure and bracing air. Many girls are said to grow out of the deformity, and these are the cases where they do so ; when, with the improvement of the general health, the muscular system at the same time becomes more developed : but in these slighter cases the cure will be much facilitated by giving the spine artificial support in the intervals of the exercise of the muscles, to avoid the inclination there will naturally be for it to fall into the curved position again ; which support may be gained by the instrument I have recommended, which has the advantage of not confining the body generally, or of interfering with the action of the muscles.

The cases in which I believe the exercise of the muscles does more harm than good, are those where the curvature, although it may be confirmed, may not yet be fixed ; by which I mean, the deformity may be very great, but yet there may be sufficient yielding in the spine to allow of it being moved or acted upon when pressure is made forcibly against

it ; where the ribs are more increased in convexity on the right side and more depressed on the left, with a corresponding projection and sinking of the scapulæ of the two sides, causing also the corresponding difference between the level of the two shoulders. Any increased power given to the muscles in these cases, without attempting mechanically to support the ribs and spine, and to support the left shoulder, which by its weight is tending to bear downwards and to increase the concavity, will, as before stated, only keep up the deformity, and in the majority of cases increase it. This opinion, I am aware, is at variance with that which is advocated by those who look to increased muscular development as an important point in the treatment of these cases ; it is formed upon the reasons I have already given, and from my own experience I believe it to be a correct one. The grand point to attend to, is to bring the spine as nearly as possible into its normal erect line ; to relieve the compressed ribs of the left side, by supporting the shoulder which is bearing upon them with its weight, at the same time that the opposite or convex side is pressed upon by a force that gradually admits of being increased. The means by which this can be done I have already described, which, from their mode of adaptation to the trunk, do not

at all interfere with the action of the muscles, or with their increased development, while they prevent them acting injuriously upon the deformity itself.

The cases in which the exercise of the muscles is of no use, are similar with regard to the nature of the deformity to those just mentioned, only are more advanced in degree. The curvature may have existed for a longer period, and have become more rigidly fixed; the ribs are more compressed on the left side, and more expanded on the right; the angles of the ribs of this side as well are permanently increased, so as to form an unyielding projection, combined with or without the second or lumbar curve; and in the majority of cases, I believe, where this angular curvature of the ribs exists on the right side to a very severe extent, there will be found to be the one curve only, namely, the general yielding of the spine to the right side. When this extreme rigidity exists, and when the curvature is of long standing, which it generally is in these cases, all the bones have become so firmly fixed in the position in which they have been displaced, as well as altered in shape, that any action of the muscles attached to them, can have little or no power in moving them or of redressing the deformity; consequently muscular exercise will be of no

avail. Something may be done, however, in these severe and confirmed cases of lateral curvature by the application of mechanical support, aided by the gradual and increasing pressure made to tell against the spine, combining with it the position which I have recommended, that tends to stretch the ligaments, and to render the spine more yielding than it otherwise would be. Much may be done also by supporting the shoulder on the concave side of the spine, thus relieving it of the superincumbent weight.

Although the deformity itself cannot be much altered as to any external appearance it may present, (though oftentimes more may be gained than might be expected,) the patient herself will always experience relief from many of the distressing symptoms, and her general health will be greatly improved by having the spine and trunk firmly supported in the manner I have described.*

It now remains to consider what the best means

* I have a patient under my care at the present time, in whom the curvature is so severe and of so long a standing, and whose age is such, as to preclude the possibility of effecting much good, who has received the greatest comfort and relief, and great improvement in her general health, by wearing an apparatus like the one I have proposed, though she has done so but for a short period.

may be to adopt, to gain whatever advantage the exercise of the muscles may offer in the class of cases in which it may be of benefit to employ it ; and here I may state, my remarks do not refer to those plans of treatment where the long-continued position of placing the patient horizontally on a couch for months or years together, are used to redress the deformity, during which time various contrivances are employed, such as pullies, &c. ; for one of my principal objects is to recommend a plan of treatment which will do away with the necessity of confining the patient for the length of time referred to.

After what I have said with regard to the few cases in which muscular exercise can be employed with any chance of benefit, or without increasing the deformity, it remains to be seen what method is the best to be adopted where it may be thought that some advantage can be derived from it. The following appears to me to be the most effectual manner of doing so ; the rules are but few and very simple.

I have already stated, that I believe the muscles can only be exercised with advantage in those cases where the spine has been brought by mechanical treatment nearly, if not quite, into the erect position ; or in those cases where, from the age of the

patient, or from the short duration of the curvature, the spine admits of being easily brought into its natural erect line with the aid of very slight pressure. Strengthen the muscles in these cases, and you will tend greatly to prevent the curvature of the spine increasing, and in many cases will be able to remove the deformity altogether.

It appears to me, that in order to make the muscles act with any chance of supporting the spine, the spinal column should first be placed as nearly as possible in the position in which it is intended the muscles should keep it. Those muscles must be strengthened in their action whose office it is to keep the spine erect, for which reason, as one rule, I should say, never place the spine in a bent position forward, by exercising with pulleys in a stooping attitude ; for at the same time that the muscles are so exercised, the spine itself is being bent in a direction that increases the deformity, and consequently, for reasons already given, the curvature will be increased rather than diminished when the exercises are discontinued.

A position employed by some surgeons to exercise the muscles, is that of placing the patient in the prone position, causing her to lie on the chest and abdomen, and then to pull herself up on the frame-work of the couch (made to run on wheels),

which, being on an inclined plane, is allowed to run down, when it is again pulled up by the arms and again allowed to run down ; and this exercise is repeated at different times of the day, for as long a period as the patient can endure. A similar plan is employed by others, only the patient is placed on the back instead of in the prone position. Neither of these modes, I believe, exercise the class of muscles sufficiently that it is important to strengthen, namely, the muscles of the back ; they principally put the muscles of the shoulders and arms into action. I do not mean that those of the spine are not partially exercised, but I am sure they are not, in the manner the most advantageous to increase their strength, and at the same time to act upon the vertebral column.

The position that I believe to be the best, is one that throws the whole spine more backwards than forwards ; which tends to redress the curvature, at the same time that the muscles of the spine are brought actively into play ; and the following is the one I should recommend. Attach two pulleys or hooks (and pulleys answer the purpose better) to the ceiling of the room, or to an artificial framework placed in some situation about two or three feet above the head. The patient is to stand in a position, that the pulleys may be about a foot and a

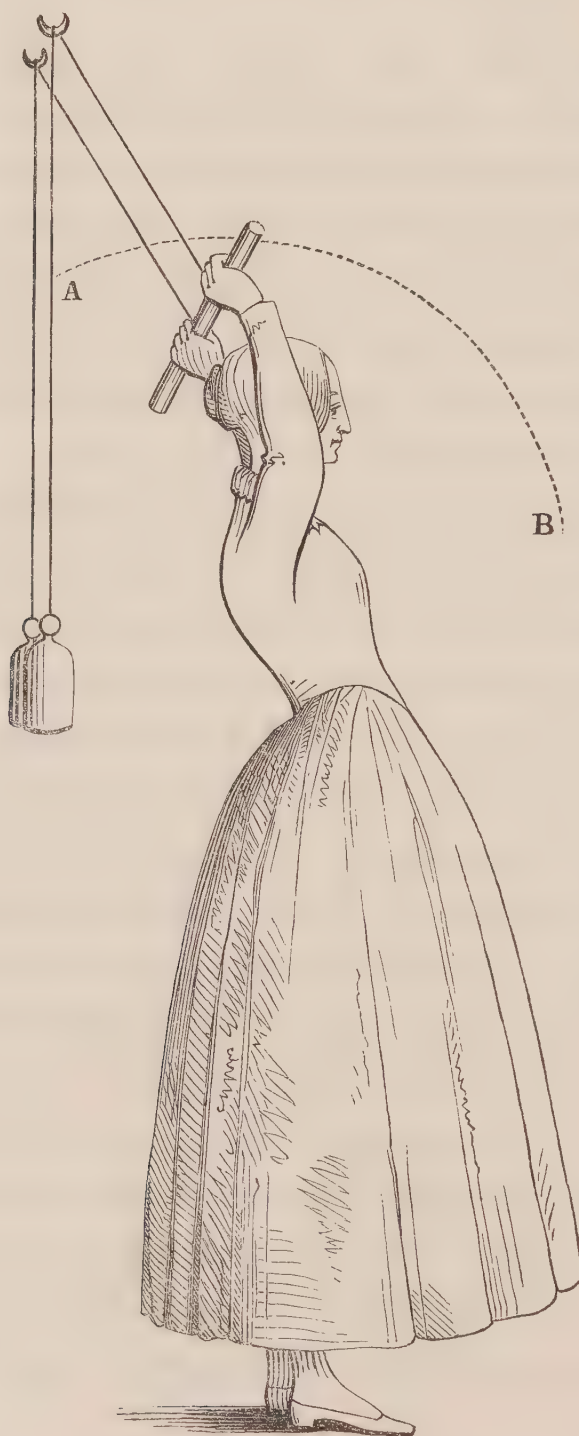
half or two feet behind her. She is then with both hands to take hold of a stick or spindle, to which two ropes are attached, and which pass through the pullies, having weights fastened at the other ends sufficiently heavy to require some exertion to draw them up, the weights of course being increased or diminished according to the strength of the patient. I generally find six or eight pounds in each quite enough, and as much as the patient can raise without over-fatiguing herself. The ropes should be long enough to allow her to incline the body forwards on the hip-joints, without bending the spine itself, drawing the weights upwards as much as she can, keeping the arms extended above the head all the time, and bringing them as far forwards as the inclination of the body will admit of, without the necessity of moving the feet from the position in which they were originally placed. The body is then to be brought into the erect position again, by raising the trunk on the hip-joints, and letting the weights fall, and so to pull the arms behind and above the head. It may be as well to tie a knot in the ropes, to check the fall of the weights, to prevent the arms being strained beyond the point of extension to which they can easily be carried behind the head.

This exercise may be repeated for a certain time

daily, and as often as the patient can conveniently do so ; the object being, not to fatigue the muscles, but by degrees to strengthen them ; at the same time, that the ribs and spinal column are brought into a position the reverse to that into which the curvature has a disposition to throw them.

When the kind of exercise that I have just described is employed, the arms are raised to a higher level and are brought behind the head, and they remain in this position while the weights are drawn up through the pulleys. During which, in order to keep the ropes upon the stretch, the spine is well extended, and all the muscles attached to the vertebral column and ribs are put into strong action. The ribs are also expanded to their utmost, by means of the pectorales and serrati magni muscles acting from the upper extremities, in a manner the most favourable to produce that effect, owing to the position in which the arms are placed. In fact, all the muscles are put into strong action, which will tend to extend the spine as well as to expand the thorax, independently of the position being one that acts in the most favourable manner upon the vertebral column itself, by the strain that it makes upon it, in a direction upwards and backwards. The feet should be kept stationary during the above movement of the arms and body, to

ensure the constant and equal action of the pulleys upon them and upon the spine. Some mark should



be made on the floor as a guide to preserve the same position ; or two rings might be fixed for the feet to pass through,—this, however, is not necessary.

The wood-cut shews the position of the patient with the arms extended above and behind the head, the pullies being placed some way behind also, to ensure the most effectual action of the muscles when they draw the weights upwards, by moving the arms in the line AB, without bending the spine ; the motion of the body being produced by the pelvis on the thigh bones.

By this plan, all the muscles of the back are put into action in the most effectual manner, including those proper to the spine itself and those connected with the ribs, as well as many of the muscles attached to the scapulæ, namely, the trapezii, serrati, and rhomboidei. Besides which, the spine itself is straightened, by the position of the arms tending to throw it backwards. The exercise may be varied by pulling with the left arm only (never with the right only) in the common kind of curvature, where the spine is thrown to the right side. Should the rarer kind of curvature exist—to the left side, the right arm may then be used instead. In the exercise of one arm only, the opposite one not in use must be allowed to hang close to the side.

The exercise may be practised as often during

the day as the patient can conveniently do so, and must be persevered in regularly, in order to gain any advantage from it; and when discontinued, the spinal support, either the one I have recommended or some other kind, should be *immediately* applied, to prevent the spine falling more into the curved position, which it would be inclined to do, from the fatigue to the muscles the exercise will necessarily have produced; or before putting on the spinal support, if the patient be weak and easily tired, she should lie in the horizontal position to recover from the fatigue. The grand principle I wish to lay down, is, to exercise the muscles with the arms placed above and behind the head, while the body is kept in the erect, and not in the horizontal position. If this principle be well carried out, and a strong and efficient spinal support be employed at the same time, I believe that all *slight* cases of lateral curvature may be cured without the necessity of employing couches at all.*

With regard to the severer cases of longer standing, where the spine is unyielding, and where the

* After well considering the various exercises that have been recommended, I cannot find any that appear to offer so many advantages as the one I have described. I attach great importance to the position of placing the arms above and behind the spine during the action of the muscles.

curve exists to a great extent, combined with the expansion and angular projection of the ribs on the right side, and the depression and contracted condition of the ribs on the left side, I believe that muscular exercise is of no use, but, on the contrary, that it does harm ; and that if it be employed at all, it should be in the manner I have above described, which, at the same time that it acts most effectually to strengthen the muscles, tends to draw the displaced ribs and spine from the curved to the straight line. The best treatment of these cases, as already stated, is to act upon the ligaments and bones principally, by placing the body in such a position that the pressure caused by its own weight shall stretch the former, and tend to force the latter into their natural position, and this is done by placing the patient on the couch I have described. After which, when the patient rises from the couch, firm support is to be given to the left shoulder, to remove the superincumbent weight from the depressed side of the thorax, while firm mechanical pressure, capable of being gradually increased, is made to tell against the opposite or projecting side of the ribs, and through them upon the curvature of the spine itself, which objects can be gained by the apparatus I have recommended.

As a general rule, I should say, in the severer

cases of lateral curvature, the nature of which I have just referred to, it will be found that as the deformity diminishes, the muscles will become increased in development and strength as a necessary consequence, without the aid of special exercises being employed; reversing the rule laid down by those who have written upon the subject, who recommend the action upon the muscles primarily with the intention of making them the principal, if not the sole cause of rectifying the deformity. In slighter cases, much, no doubt, may be done by the judicious exercise of the muscles; but even in those, the cure would be much facilitated by combining with it firm mechanical support, so employed that it may assist the muscles rather than confine them.

I trust the plan of treatment that I have recommended for the lateral curvature of the spine, may be attended with success in the practice of others, should they deem it worthy of trial. So far as my own experience has gone, I am convinced of the great advantage to be derived by the position of placing the patient on the side, to produce lateral flexion of the whole vertebral column in the opposite direction to that in which the curve exists, as a

means to overcome the resistance of the ligaments in the most effectual manner ; at the same time that it expands the contracted ribs, and tends to bring the vertebræ out of their unnatural position into the natural one.

This position may be gained by any means which admit of the patient being placed on the side, with the legs depending at the one end, and with the head and upper extremities depending at the other. A simple frame-work placed across a sofa, with the belt attached to it, to act in the manner I have recommended, will answer the purpose, if the couch I have described cannot be obtained. The great point gained by the couch is, the facility it offers of carrying out with the most effect the principles I have mentioned, combining ease and convenience with the power of increasing or diminishing the strain upon the spine and ribs at pleasure, by altering the angles of the frame or of the level of the belt on which the patient lies. I have been in the habit of employing this couch in my own practice constantly during the last three years, making the patients lie on it for an hour daily, and immediately afterwards applying the firm mechanical support, by means of the apparatus I have described. The success that I have obtained by following this plan is such, as certainly to induce me

to continue it, with the hope of even affording relief (however trifling it may be) in cases in which, from the form as well as from the duration of the curvature, the treatment by extension would be out of the question.

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